Electrical World

SEPTEMBER 29, 1945

-Kv. Line Incorporates Modern Techniques

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Inrush Following Distribution Outage

•

Disinfection with Germicidal Lamps

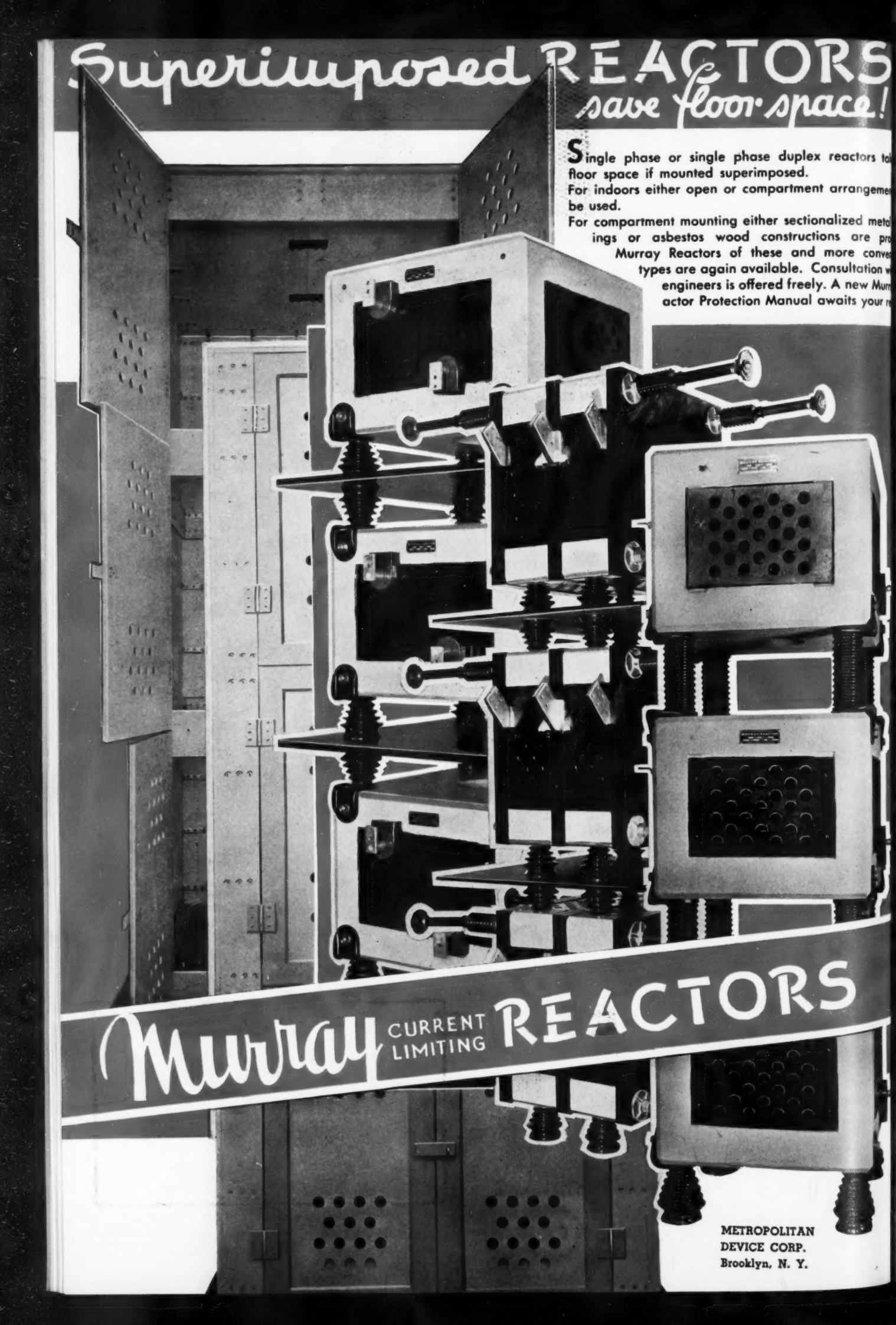
•

-Automatic Operation Small Hydro Plant

•

dard Source Calibrates Cycle Frequency Meters

Bird-Cage Type Working atform Simplifies Mid-an Splicing Operations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September 29, 1945 — Vol. 124, No. 13

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ELECTRICAL WORLD

Published weekly. Price 25 cents a copy. Publication office 99-129 N. Broadway, Albany 1, N. Y. Allow at least ten days for change of address. Address communications about subscriptions to Director of Circulation, Electrical World, 330 West 42nd Street, New York 18, N. Y.

RETURN POSTAGE GUARANTEED

Subscription rates: In the United States, Mexico, Central and South American countries, $5 a year, $8 for two years, $10 for three years. Canada $6 for one year, $10 for two years, $12 for three years (Canadian money at par). Great Britain and British possessions, 60 shillings for one year, 120 shillings for three years. All other countries $9 for one year, $18 for three years. Please indicate position and company connection on all subscription orders. Entered as second class matter November 18, 1936, at Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

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Branch Offices: 520 North Michigan Avenue, Chicago 11, Ill.; 68 Post Street, San Francisco 4; Aldwych House, Aldwych, London, W.C. 2; Atlanta, Ga.; Boston, Cleveland, Detroit, Los Angeles, Philadelphia, Pittsburgh, St. Louis, Washington.

McGRAW-HILL PUBLISHING CO., INC.
JAMES H. McGRAW
Founder and Honorary Chairman

Publication Office
99-129 North Broadway, Albany 1, N. Y.

Editorial and Executive Offices
330 West 42nd St., New York 18, N. Y.

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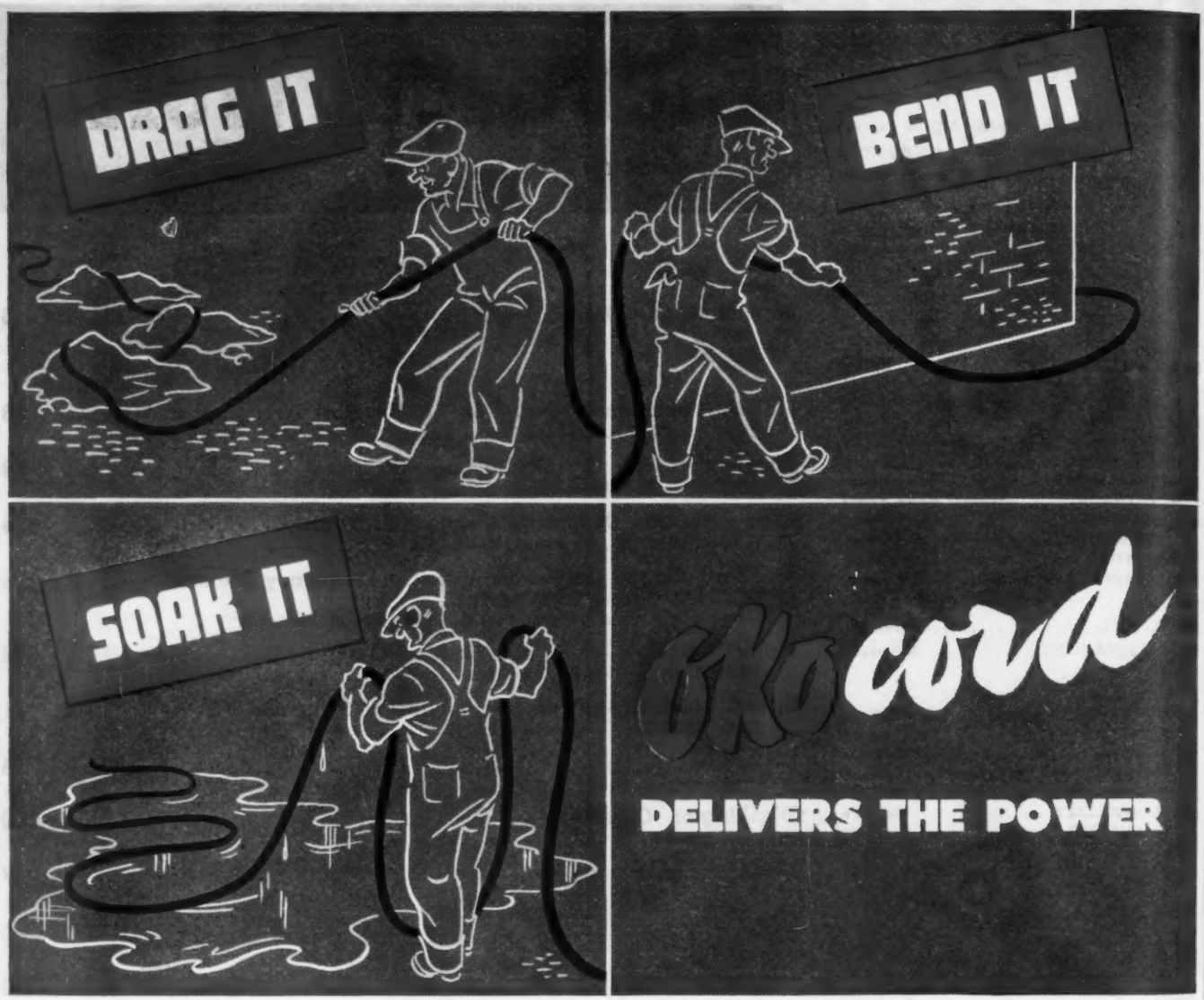

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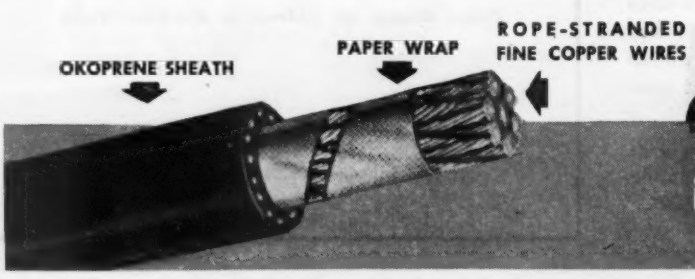

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Electrical World
SEPTEMBER 29, 1945

A Grand Job

JUST AS the electric utility industry was the first great business of this country to be prepared for the demands of war, so is it the first to be prepared for the demands of peace. This week it was demobilized with the closing of the Office of War Utilities and the control of its operation returned to management.

For more than four years this industry was subject to restrictions made necessary by military demands, yet so thoroughly did the utilities and OWU and its predecessors work together that not only was the war served, but the civilian economy as well. Without taking away one iota of credit from the utilities for America's outstanding war job, it can be stated in all fairness that the job could not have been done with any agency with less comprehension of the business.

First the Power Division of WPB and then the Office of War Utilities held to a philosophy of utility service that was basic and repelled any suggestion that was contrary thereto, the principle of essentiality of total requirements. In other words, electric service being unrationable, the requirements for furnishing it are not divisible.

When coal was becoming short in supply a great many important people in Washington did suggest curtailing utility supply along with that for other fuel users, but OWU by holding to its fundamental kind of thinking was successful in protecting the industry from any restrictions that would have prevented it from giving total service.

To carry out this philosophy two things were necessary—total jurisdiction and a competent staff devoted to a single purpose regardless of social, political or economic background. Without this concentration of authority in OWU the industry in more than one instance would have found itself the innocent victim of jurisdictional disputes, not the least of which might have been fuel supply.

Even with the right policy and all the authority to make it work it would not have been possible to accomplish so much and so well were it not for a staff that not only was able but which worked together regardless of background. One of the first principles to be established was that the agency had but one job, that of winning the war against the country's enemies. It was to take no part in the contest between public and private ownership. Its decisions were to be made solely on the premise of what was best for the war effort.

Making the decisions that were to fashion the construction and operating practices of the utility industry, was a job for men of courage as well as engineering ability, for men of integrity who would not be swayed by selfish impulses, for men of character who would not let personal sacrifice stand in the way of doing their part.

These were the things—policy, authority, and staff—that made it possible for OWU to give to the electric utilities of the country the kind of assistance and protection that enabled them to say—as no other major industry could say—never too little or too late not only for war but for the civilian needs as well.

It was a grand job of direction and teamwork, spiced with a generous amount of understanding, courage, sacrifice, integrity, and unselfishness. The greatest compliment it could ever receive from a grateful industry is the full measure of cooperation and assistance it had from the electric utilities.

Modern Techniques Mark New 132-Kv. Port Washington Line

Two-cycle carrier current pilot wire relaying, progressive line design and mechanized construction are features of war-time built 132-kv. line linking Port Washington station with Milwaukee system. Thirty-man force performs all construction operations

E. W. HATZ, E. L. McCLURE†, and R. L. DODD#, Wisconsin Electric Power Co., Milwaukee*

THE 23-MILE, 132-KV. transmission line linking Port Washington station with Wisconsin Electric Power Co.'s Milwaukee system was neither the longest nor highest voltage transmission circuit built in 1944. However, the necessity for it and the features of its design, protection and construction combine to make its history noteworthy.

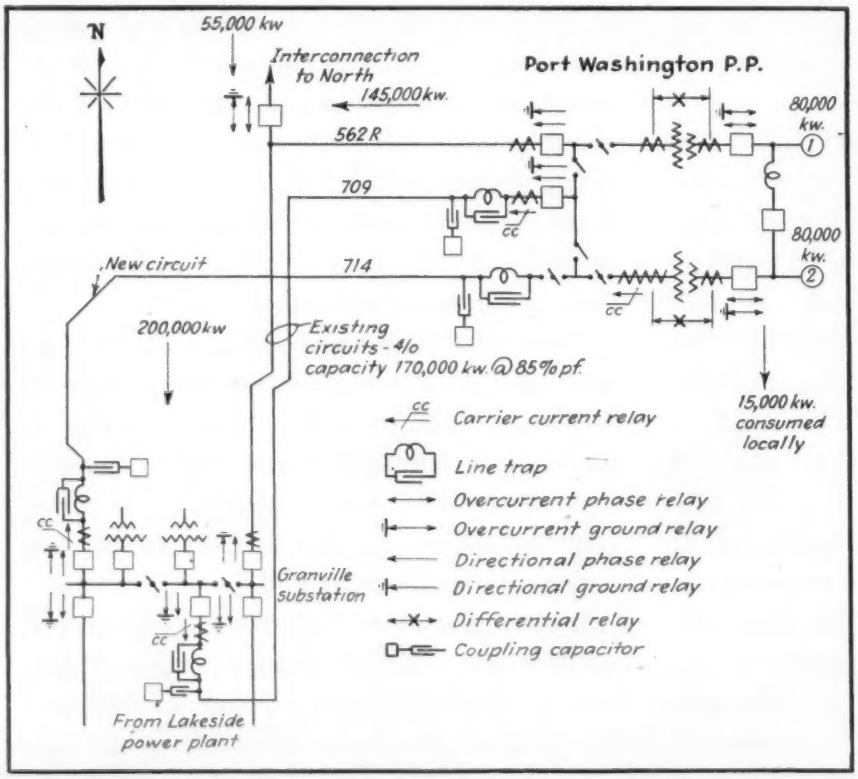
Necessity for the line grew out of the fact that in 1943 a second 80,000-kw. turbo-generator unit had increased the capacity of Port Washington station to 160,000 kw., of which only 15,000 kw. was used locally. Without a new circuit the remaining 145,000 kw. plus 55,000 kw. from an interconnection with hydro plants in northern Wisconsin would have to be transmitted south, to Milwaukee's Granville substation, over a double-circuit steel-tower line of only 170,000-kw. capacity at 85 percent power factor. Most of this existing double-circuit line was over 20 years old and more susceptible to double-line failures than those lines of more recent design.

Considering that winter peak load in the Milwaukee area was about 500,000 kw. in 1944 an outage on both, these existing circuits, north of Granville substation, at a time when one of the 60,000-kw. generators in Milwaukee was down for maintenance would have meant dropping 138,500 kw. of load in a vital war area. Loss of only one of the circuits to Port Washington under the same circumstances would have meant dropping 53,500 kw.

Moreover, without the proposed third circuit, loads on the two existing circuits would have been so great that outages for line maintenance could not have been arranged.

On the merits of these facts construction of the new third circuit was authorized and put in service in October, 1944. It has a capacity of 120,000 kw. and was built over right-of-way sufficiently removed from the older tower line to avoid simultaneous failures.

* Transmission Engineer
† System Engineer
# Asst. Supt. Construction



CARRIER-CURRENT PILOT WIRE relaying clears faults in line sections of new 132-kv. circuit (714) in ten cycles; eight cycles for breaker operation, two cycles for relaying. Diagram shows relaying on all three circuits

Stability Studies

Calculating board analysis of stability for the entire system, with its interconnections, proved the need for the high-speed differential relaying selected for the new line.

Accompanying swing curves plotted for Port Washington and Lakeside power plants show that the angular displacement between generators at these stations is about 8 deg. How-

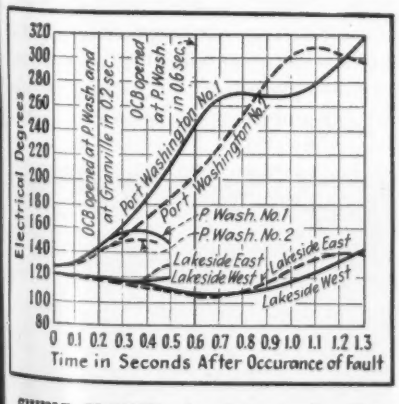
Basic Statistics
Port Washington-Milwaukee
132-Kv. H-Frame Line

Total length of line, miles	23.00
Length of line 300,000 cir. mil. copper, miles	9.55
Length of line 477,000 cir. mil. ACSR, miles	13.45
Voltage, kv.	132
Ruling span, ft.	700
Tension, lb. (½ in. ice, 8 lb. wind, 0 deg. F) copper	6,080
Tension, lb. (½ in. ice, 8 lb. wind, 0 deg. F) ACSR	7,300
Tension, lb. (½ in. ice, 8 lb. wind, 0 deg. F) ⅜ in. Copperweld ground wire	6,000
Conductor spacing, ft.	15.5
Tangent structures, number	175
Deadend structures, number	8
Angles structures, number	17
Poles, specifications	65 ft. Class 2 WRC

ever, during a short circuit near Port Washington station, its generators lose load and accelerate while the more heavily loaded units at Lakeside station in Milwaukee fall off in speed. By clearing the short circuit at Port Washington in 0.2 second, generators at these two stations will pull into step and resume their original position. However, if the Port Washington fault is not cleared until 0.6 second, as shown on the curve, the delay is too great and the stations are pulled out of synchronism and must be resynchronized. In the case of Lakeside station this might mean dropping enough load to restore normal frequency.

Two-Cycle Relaying

Relaying adopted for the three 132-kv. Port Washington-Granville circuits is diagrammed herewith. Circuit 714 (newest) and 709 are equipped with carrier current pilot wire protection adequate to clear faults within their line sections in 10 cycles; eight cycles for the oil circuit breaker and two cycles for relaying. Circuit 714,



SWING CURVES, showing angular displacement between generators at Port Washington and Lakeside for three-phase fault, reveal need for high speed switching to maintain stability

however, is not equipped with an oil circuit breaker at Port Washington. Instead, differential protection on the step-up transformer there is interconnected with the carrier relaying system to trip the Granville breaker. The tripping impulse on this breaker is made in six cycles, after operation of the differential relays at Port Washington.

The type of carrier-current pilot-wire protection chosen compares the direction of current flow at the two ends of the line in a manner similar to any differential protection system. Comparison, however, is made by electronic means.

On circuit 562, to which interconnection is made from northern Wisconsin, high-speed three-phase protection has been provided to maintain stability. This initial protection has been designed to cover the zone near Port Washington in which high-speed tripping is required for stability.

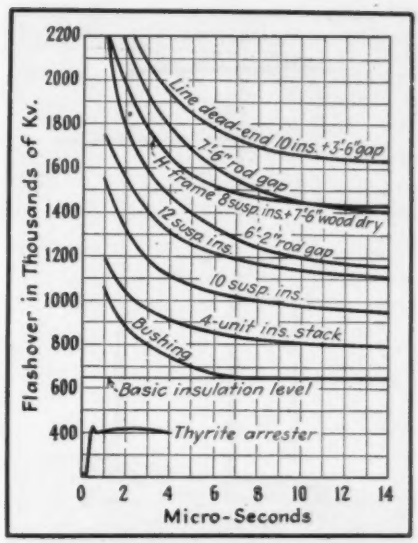
Line Design Features

Material shortages forced the use of two different conductor materials in this line. Conductors of 300,000 cir. mil. bare stranded copper are used for about one-third of the line and 477,000 cir. mil. ACSR on the remaining two-thirds. Ground wires are ⅜-in. extra-high-strength Copperweld.

Because the availability of critical conductor materials changed in the three years between purchase of the first and final right-of-way, different conductor materials were given preference in laying out span lengths on different line sections. This resulted in some reduction in average span length below that which would have been obtained had the conductor materials finally used been known when the project started.

Design of the tangent H-frame structures was in line with current practice. Poles are 65-ft. Class 2 Western cedar with full-length pentachlorphenol treatment and the usual creosote butt treatment. Somewhat unusual was the use of the metal spacers that support the double arms to support the insulators also. As a protection against contact with a live conductor in event of failure, the cross tie between down-lead ground wires on each pole is run through the cross braces.

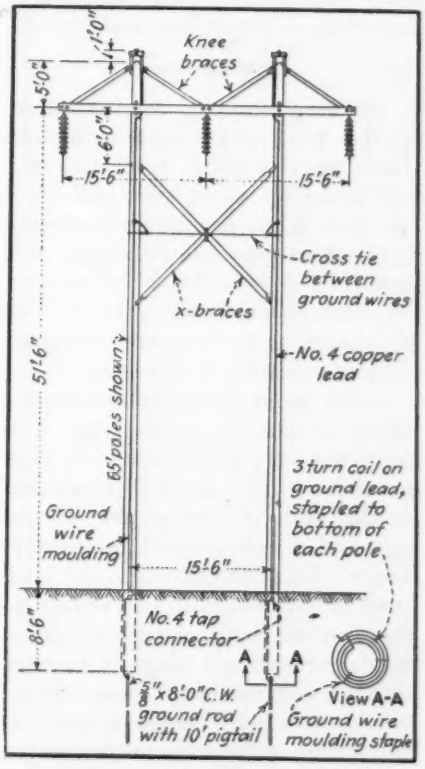
Position of the conductors, 7 ft. 9 in. from the center of the H-frame



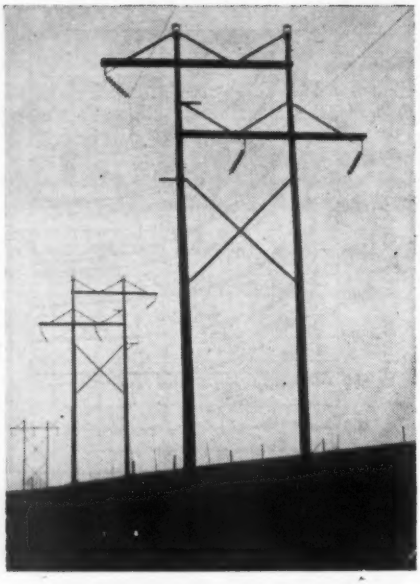
INSULATION coordination curves for H-frame line and substations; insulation level indicated

poles and the down-lead ground wire on the pole, establishes the insulation level of the line. Flashover of this gap approximates that of the alternative flashover path across eight suspension insulators and 7 ft. 6 in. of wood. The latter is reduced when the wood becomes wet and the air gap is likewise reduced by wind blowing across the line.

At dead-ends, ten insulators plus a



TYPICAL TANGENT STRUCTURES. Note cross tie between down-lead ground wires passing through cross braces; a protection against contact with live conductor on failure



TRANSPOSITION OF CONDUCTORS is done in 300-ft. span between two line structures of special design

gap of 3 ft. 6 in. on a wood guy strain insulator provides a flashover in excess of that on H-frames. At angles and transpositions, a flashover equivalent to or greater than that on an H-frame is obtained by holding the grounding wires away from both the conductors and the pole bands that support insulators. Thus there is always wood insulation, in addition to porcelain, between line and ground.

Transposition

A transposition of conductors required two special line structures. These were set 300 ft. apart with normal spans on either side. All wires involved in the transposition crossed in the short span where the sags were less than one-third of the vertical separation between wires. In this way clearances were rendered adequate without resorting to dead-ends.

At the point where the line crosses under an existing 132-kv. line, it is protected against contact by ungrounded shield wires that are suspended midway between the two circuits and at right angles to conductors above. These shield wires are insulated to withstand full line voltage so that contact with an upper circuit conductor will not cause it to burn through and reach the lower circuit. Shield wires are of the same material and strung at the same tension as the overhead ground wires which terminate at each side of the crossing.

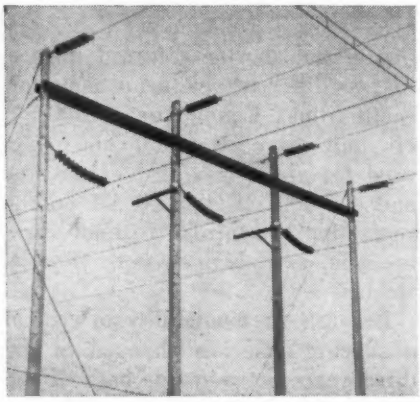
Ground wires are strung with less sag than line conductors to obtain the necessary mid-span separation and improve the protection angle, which is 35 deg. at the H-frame; 20 deg. at mid-span.

Structure footing resistance is held at 10 ohms or less by a coil on each pole butt and a ⅝-in. by 8-ft. rod driven at the bottom of each pole hole. Additional rods or counterpoises are installed as necessary to hold the resistance to 10 ohms.

Construction Mechanized

Construction of this line was done by company forces using available equipment and a minimum of outside help and machinery. A high degree of construction mechanization kept the working force down to 54 men. Of these only 30 were needed on the job at any one time to perform all operations.

Careful crew training following J.I.T. procedure coupled with advance study of construction operations and the preparation of detailed job procedure specifications contributed to execution of the job in an efficient manner with a minimum number of men. Contributing also to this achievement were some 21 special equipment and tool items evolved for the job; many suggested by workmen in their search for a "better way."



PASSING UNDER an existing 132-kv. line, new circuit conductors are protected against contact by four ungrounded shield wires (top) insulated for full line potential

Assembly of the 175 two-pole H-frame structures on the ground was essentially a final assembly operation involving prefabricated sub-assemblies in the form of crossarms, braces, insulator strings, ridge irons and ground wires. As such it was a production job and executed according to procedure specifications by a special crew trained on a small scale model following J.I.T. methods. Other operations for which procedure specifications were prepared included: Erecting H-frames; preparing and erecting 3-, 4- and 5-pole structures; framing multiple pole structures; pulling and sagging wire; clamping and final line work; splicing ACSR conductors; splicing ground wire and check patrolling the completed line.

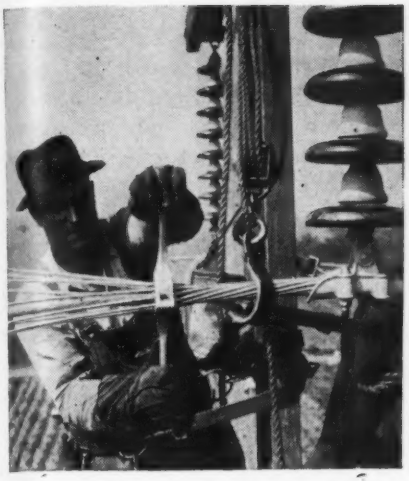
In assembling structures on the ground, unlike ordinary pole line work, crossarm through bolt holes were the last bored and bolted. This apparent reversal of sequence in line construction arose because braces, pole spacing, brace attachments on poles and arms were predetermined by dimensions of the factory assemblies furnished in the field.

Erection of Structures

Layout of the structures was simplified by the use of boring and marking jigs and clamps. Pole leveling, fitting and framing measurements were all made from the top of the poles rather than from the butt. Reference nails, driven in each pole at points exactly identical distances (55 ft.) from the top were used in these operations. Structures were squared by diagonal tape measurements made between these nails and bolt holes in the prefabricated crossarm assembly, as shown. Leveling was accomplished by digging pole holes to proper depth and setting the poles of each structure with their tops exactly level. Straight edges resting on the reference nails were used, during setting, to make level adjustments.

Erection of all structures was completely mechanized. Cranes, power hoists, chain hoists, levers, cant hooks, special gins, tractors and trucks were the order of the day. A crew of 11 men erected all H-frames. They dug holes with a power auger, raised structures with a rented 50-ft. boom truck crane, plumbed with ingeniously-rigged guy lines, drove and connected

GROUND ASSEMBLY of H-frames was expedited by jig for locating and boring pole holes and use of electric drill powered from generator in trailer



INSTALLING ARMOR RODS on 477,000 cir. mil ACSR line conductors

ground rods at each pole, tamped the backfills and removed all erecting and guying tackle without climbing the poles. This crew, ground and weather conditions permitting, were able to complete six structures in a nine-hour day.

Erecting tackle for H-frames consisted of a 14-ft. strut jacked between the poles and a ¾-in. steel cable bridle lifting hitch. This was rigged and attached so that a pull on certain hand lines would disconnect it for lowering when its job was completed.

Anchors

Anchors for the 15 guyed angle-structures were 16-in. cones in good soil and deadmen in soft. The cone anchors were tested with a special dynamometer testing frame at 10,000 or 12,000 lb. before acceptance. If they slipped due to soil conditions they were replaced with deadman anchors 6 ft. to 12 ft. long as needed. A few 10-in. screw anchors were used as supplementary transverse wind guys in swampy soil.

Exception to the general rule of ground assembly of structures were the 25 three, four, and five-pole structures, mostly at angles in the line. These were set one pole at a time and assembled in the air.

Stringing Conductors

Because of the inherent flexibility of H-frame structures in the direction of the line, it was necessary, during stringing, to hold deadending and sagging stresses at the end of every section of wire with temporary 13-ft. guy stubs and anchors.

Aside from special operations at angle structures, poles were climbed only twice: First, to place the wire stringing blocks with a hand line through each block; and second, to transfer the wires into their permanent clamps and then to remove the blocks.

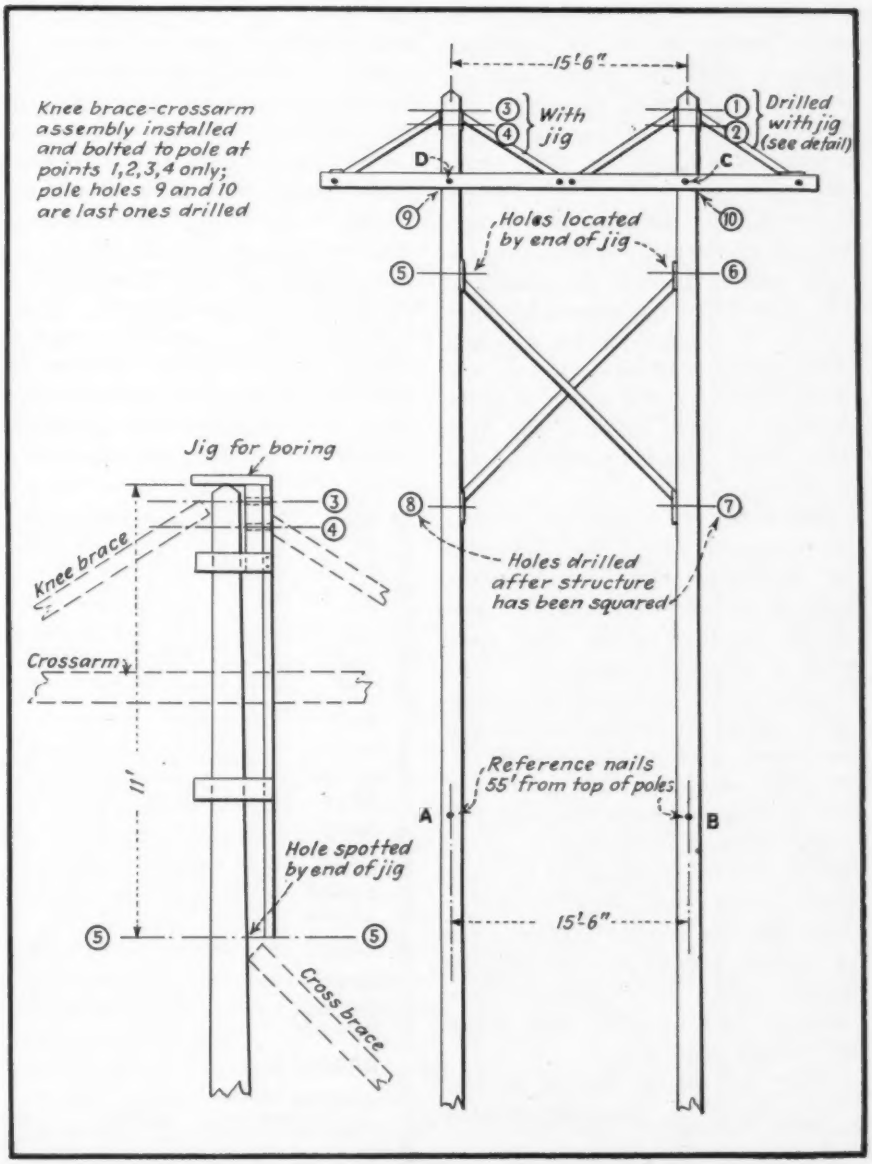
The ⅜-in. Copperweld ground wires were strung in 5,000-ft. lengths; the aluminum in 6,600-ft. lengths and the 300,000 cir. mil. copper in two 2,700-ft. lengths and spliced in the field to make 5,400 ft.

Wherever possible five wires were pulled at the same time on the copper section of the line. On the 13-mile aluminum section where the wire was pulled under slight tension, to prevent damage by dragging over stones and fences; conductors were strung one at a time.

The usual sag stakes and sag tape measurements familiar to tower-line construction men were not used. Instead direct reading dynamometers, between pulling equipment and "come-alongs" were used in pulling each wire to the required tension and sag.

In the 13-mile aluminum section of the line, conductors at each suspension clamp were enclosed in 7-ft. aluminum armor rods twisted and clamped in place. Dead-ends were protected by Stockbridge dampers clamped to the wires near each end of the span.

Stringing operations were expedited by grounded magneto telephones, at 1¼-mile intervals, connected to the first conductor strung and used during the balance of the stringing, sagging and clipping operations; this communication supplemented flag signals.



H-FRAME ASSEMBLY PROCEDURE CHART shows numbered sequence of boring and bolting. Detail shows use of jig for locating knee and top cross-brace holes

Disinfection with Germicidal Lamps: Control—I*

Special techniques developed for working with wave lengths of 2,950 Angstrom units, including measuring devices—Reflection and transmission factors differ from ordinary light

*MATTHEW LUCKIESH,** General Electric Co., Cleveland, Ohio*

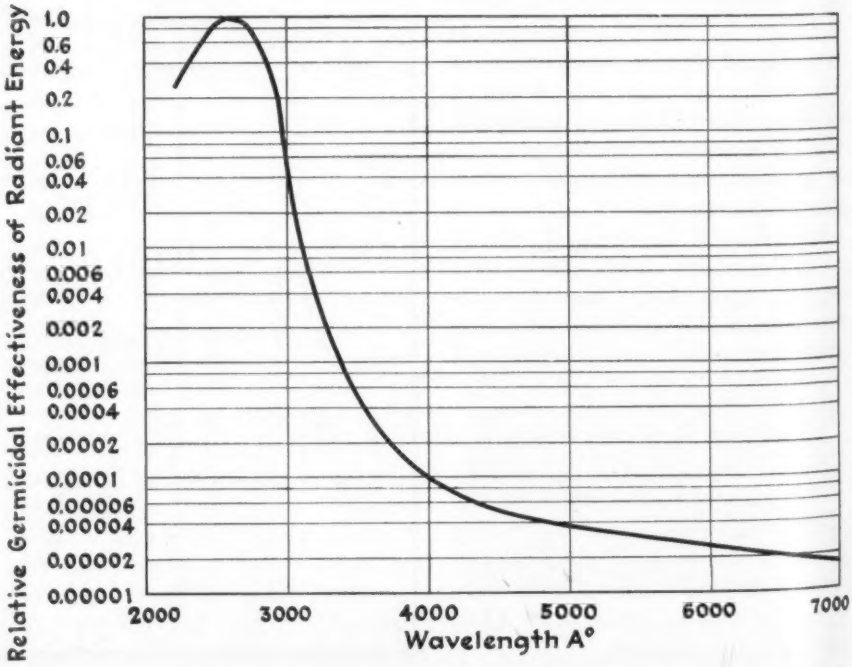
LONG BEFORE the discovery of ultraviolet energy in sunlight, in 1801, sunlight was known to be essential to life and beneficial to human beings in many ways. Just how some of the major benefits are achieved remained unknown until the present century. Others still remain mysteries and there is reason to believe that all the benefits of sunlight, or of its artificial equivalent, are not yet known. However, after the discovery of bacteria the germicidal power of sunlight soon became known. Eventually it was proved that the germicidal effectiveness of sunlight is due to ultraviolet energy near the short-wave end of the solar spectrum which is in the vicinity of wave length 2950 Angstrom units. This is briefly expressed as λ2950.

Researches with artificial sources of ultraviolet energy have revealed that germicidal effectiveness rapidly increases as the wavelength decreases beyond the limit of the solar spectrum. It becomes a maximum in the vicinity of λ2600. Shortwave ultraviolet energy is emitted by the sun but, owing to the existence of the atmosphere, this powerfully germicidal energy does not reach the earth. If in that suffocation the curtain of atmosphere were drawn aside for only a day, many plants would receive a death sentence and the exposed areas of human beings and all animals would receive an extremely severe sunburn. In a week the earth would be terribly scorched.

There are serious lessons in this. Living things are generally adapted to their environment and, therefore, sunlight which reaches the earth is generally beneficial rather than lethal. Short-wave ultraviolet energy can kill any living cell or organism which is not adequately protected by an absorbing medium. It is only necessary for the exposure, which is primarily the product of intensity and time, to be adequate. The necessary exposure varies greatly with the kind and size of the living thing. Short-wave ultraviolet energy not only kills living things but it will fade colors and alter the surface of many materials. In any contemplated use of germicidal energy one should bear in mind that its destructive power is not limited to bacteria. It is essential that this lethal tool be used properly, but this is true of guns, drugs, automobiles and other inventions.

Appraising Germicidal Energy

The figure provides the key to the appraisal of sources of germicidal energy. This curve was determined by the author and his colleagues, L. L. Holladay and A. H. Taylor, for B. coli which are generally accepted as being fairly representative of pathogenic or disease-producing germs. The vertical scale is logarithmic in order to encompass the great range in values of germicidal effectiveness. There is some indication that the wavelength of maximum effectiveness may differ slightly for different organisms. Even if true, this is of little practical importance. However, it



RELATIVE GERMICIDAL EFFECTIVENESS of equal amounts of radiant energy of various wavelengths as determined for B. coli

* This article is in three parts. The next installment will deal with disinfecting air and the final part will deal with water treatment.

** Director Lighting Research Laboratory.

is known that the absolute effectiveness of germicidal energy varies greatly with the type and size of the organism. For example, certain fungi and molds are many times more resistant than pathogenic germs. In other words, much greater exposures are required to kill them.

Ultraviolet Sources

Let us then examine and appraise sunlight, the quartz mercury arc and the new low-pressure mercury arc with its special ultraviolet-transmitting glass, better known as the germicidal lamp. By a fortuitous coincidence practically all the ultraviolet energy emitted by the new so-called germicidal lamp is in a narrow spectral band at λ2537. As seen in the illustration, this is in the region of maximal germicidal effectiveness. The older quartz mercury arc which has been used for some germicidal purposes emits energy throughout the ultraviolet spectrum. Therefore, much of this energy is of low germicidal effectiveness. Actually, a 30-watt germicidal lamp has a germicidal efficiency about ten times that of the older quartz mercury arc. In other words, a 30-watt germicidal lamp is about as effective as a 300-watt quartz mercury arc.

The spectrum of sunlight at the earth's surface ends in the region of λ2950. From the figure it is seen that the germicidal effectiveness of this short-wave energy in sunlight is a very small fraction of that in the region of λ2537. The high intensity of sunlight makes up for this somewhat, but still a 30-watt germicidal lamp is as effective germicidally in one minute as average sunlight is in about an hour. And the germicidal lamp is available at all times, at night as well as during the day, and in winter as well as summer. The germicidal effectiveness of sunlight varies enormously with the hour of the day and with the seasons. No cloudiness obscures the germicidal lamp excepting dust which can be wiped off.

These glimpses reveal something of a new era of disinfection and sterilization which is in the making. The necessary science which reveals what germicidal lamps can accomplish has been in the making for several years. Measuring devices and techniques have been developed. Thus the technology for the use of germicidal lamps is evolving. Knowledge is already far ahead of practice in some major avenues. Therefore, let us glimpse some of the many uses already revealed.

Controlling Germicidal Energy

For the use of germicidal lamps it has been necessary to develop materials which will efficiently transmit and reflect energy at λ2537. Great improvements have been made in glass available for the bulbs or tubes. Years ago we noted that a reflector made by spinning a sheet of aluminum had a reflection-factor for short-wave ultraviolet energy measurably different from a reflector made by pressing from the same sheet of aluminum. This led to special consideration of the treatment of the surface of the aluminum. Although knowledge is still incomplete, specially treated aluminum which reflects 80 to 85 percent at λ2537 is now available. Recently we measured a specimen which reflected 89 percent of this energy. This is a great improvement over the reflection-factors of 50 to 60 percent of a decade ago. Similar improvements have been made in aluminum paints.

In some uses of germicidal energy it is desirable to absorb the energy. For example, when the upper portions of rooms are used as "irradiation chambers" in which to kill the germs rising by convection currents and otherwise, it is desirable that a minimum of germicidal energy be reflected from the ceiling and upper walls to the eyes and skin of occupants of the room. Fortunately, most paints do not reflect this energy efficiently. However, the reflection-factor for germicidal energy is high for some materials, and paints can be made with high reflection-factors if desired. A few of the useful materials, with their reflection-factors for λ2537, are listed in the table. These have been selected from a large number of specimens of various materials to illustrate the salient points. It will be noted that zinc oxide is highly absorbing. Specimens differ markedly but the data in the table are fairly representative.

Ordinary glass is quite opaque to the germicidal energy under consideration. It is useful in protecting the face in many industrial uses. However, a glass surface will reflect about 4 percent and much higher percentages at large angles of incidence.

Reflection-Factors, Expressed in Percent, for Germicidal Energy of Wavelengths in the Region of λ2537

	Percent
Aluminum	
untreated surface	40–60
treated surface	60–89
sputtered on glass	75–85
paints	55–75
Stainless steel	25–30
Tin plate	25–30
Magnesium oxide	75–88
Magnesium carbonate	65–70
Calcium carbonate	70–80
Plaster, new	55–60
White baked enamels	5–10
White oil paints	5–10
White water paints	10–35
Zinc oxide, dry pigment	1– 2
Zinc oxide paints	4– 5
White paper	25–85

Precipitation of Flue-Gas Dust

Pulverized anthracite duff showed the following composition in a British analysis: percentages of moisture, 6, volatiles, 6 to 8, carbon 74 to 80, ash 15; ash fusion temperature, 2,300 deg. F., calorific value, 12,300 Btu. per lb. Representative samples of ash showed the following percentages: silica (SiO_2), 53; alumina (Al_2O_3), 28.7; iron oxide (Fe_2O_3), 7.4; lime (CaO), 3.3; magnesium (MgO), 1.3; titanium (TiO_2), 1.8; sulphuric anhydride (SO_3), 1.5; alkalies, 3.0. This data is from a recent IEE Power Engineering Section paper by John Bruce. It was further reported that dust concentration ranged from 4 to 8 gr. per cu. ft.

Static rectifier equipment operated at 45-50 kv. was used to precipitate the dust and test showed efficiency of precipitation ranging from 98.3 to 99.6 percent and dust burdens of flue gas leaving precipitator not over 0.21 gr. per cu. ft.; no soot blowing was carried out during these tests.

The boilers are 230,000 lb. per hr. units and were operated at maximum continuous rating. Throw out of flue gases was 133,000 cu. ft. per minute and carbon content of dust in the flue gas presented to the precipitator at maximum output was 40 percent. This high percentage of carbon emphasized the tendency of partly ionized particles to escape from the field.

Eighty percent of the quantity precipitated was precipitated within the first half of the precipitator; only 6 percent was thrown down in the last quarter of the length.

Load Adjusting Device for Unattended Hydro

Float actuates cams that operate governor synchronizer motor so as to change load on turbo-generator in accordance with stream flow—Available pondage utilized during periods of low stream flow—"Self-Compensating" for change in head

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IN 1942 the economics of operation as well as the developing critical manpower shortage made it advisable that one of the company's small hydro plants be equipped for semi-automatic operation so that the operating staff could be transferred to larger plants where they were needed.

The small plant is located in a mountainous area where run-off is very rapid. Following a heavy rain, the stream flow often increases from 100 c.f.s. to 1,000 c.f.s. or more in a few hours and recedes almost as fast. The turbines consist of two 700-hp. Francis wheels operating under 34-ft. head. The capacity of the generators is more than adequate to handle the requirements of the local area when for various reasons the tie-line with the remainder of the company's system is out of service.

Carry Local Load

It was felt that the relaying should be arranged so that this plant would carry the local load without interruption during outages of the tie-line, utilizing the available pondage in the lake during periods of low stream flow. This arrangement would not only provide a better continuity of service to the local area, but would also hold water wastages to a minimum since the machines would be carrying a partial load following a tie-line outage instead of floating at no-load.

The expense incidental to installing automatic re-synchronizing equipment was not considered justified since the plant is located within 5 mi. of a branch office of the company and tie-line outages are infrequent. Always available at this location are employees who can be dispatched to the plant to re-synchronize when necessary. An alarm circuit from the plant indicates when an attendant is needed for any reason.

These considerations precluded the use of the gate-limit type of headwater control as manufactured by the makers of the governors, since during

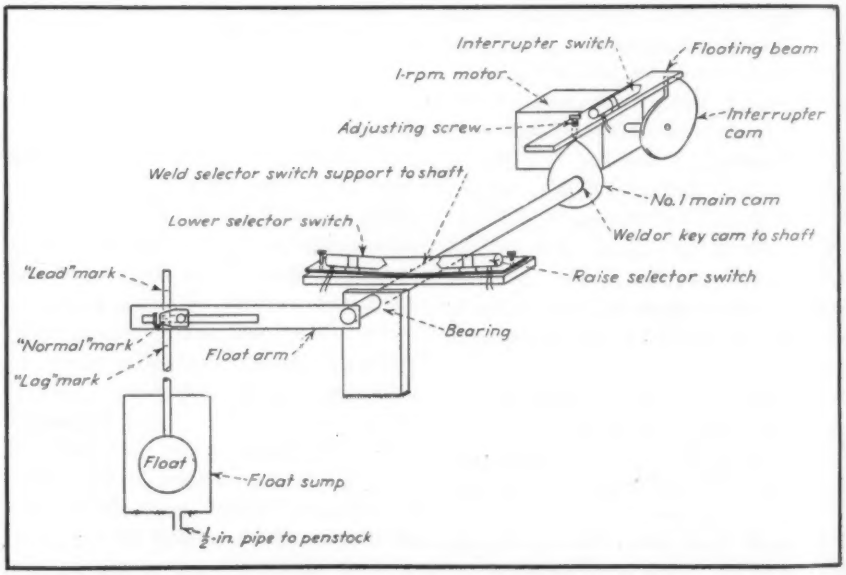

FIG. 1—Two cams designed so that one predetermines sensitivity and the other duration of impulse, to operate governor synchronizer motor

1. When float arm is at a certain point above horizontal, "raise" selector switch is closed; when below, "lower" is closed; when horizontal both are open. Float arm movement limited by stops (approximately 45 deg.)
2. With float arm horizontal, point of adjusting screw on floating beam (upper right) rests on peak of No. 1 cam
3. As float arm moves, main cam rotates and causes floating beam to tilt. Adjusting screw set to allow interruptor switch to close contacts when float arm is predetermined displacement from horizontal
4. As soon as interruptor cam rotates far enough to allow end of floating beam to move down the cut off portion, interruptor switch is opened irrespective of position of No. 1 main cam. (Interruptor cam rotated at 1 rpm. by small fractional horsepower motor)
5. The two cams are so shaped that length of impulse to governor synchronizing motor is directly proportional to distance of float arm above or below horizontal

Note: Rear shaft bearing and guide for floating beam omitted for clarity in detail.

periods of low stream flow, the gate limit device would prevent the machines carrying the local load. An inexpensive device was therefore developed which operates the governor synchronizer motor to change the load on the turbines in accordance with the stream flow. Mercury switches of the sensitive type (operating at angle of $\frac{1}{4}$ to $\frac{3}{4}$ deg.) were used throughout to provide a simple design free from contact troubles that are due to dirt and grit.

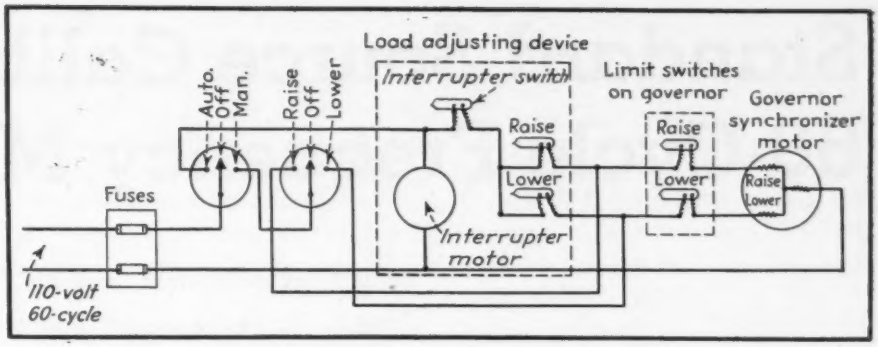

FIG. 2—Electrical connections of switches shown in Fig. 1

Design Details

Principal parts of the device which was developed to meet the previously stated requirements are shown in Fig. 1.

Shape of the No. 1 main cam controls the sensitivity of the device to changes in lake elevation and the shape of the interrupter cam controls the length of the impulses sent to the synchronizer motor. The desired length of impulse is determined by the speed of operation of the synchronizer motor, the speed droop setting of the governor, and the speed with which the governor will change its gate opening in response to changes in the synchronizer setting.

Two limit switches (Fig. 2) are installed on the Woodward Type HR governor to open the "raise" and "lower" circuits when the governor speeder spring tension is outside the limits of 60.5 to 59.5 cycles, respectively (closer limits could be set but are not considered necessary). These limit switches are pivoted in the same manner as the "Speeder Spring Tension Indicator" and are mounted on the opposite side of the governor head from the indicator. The tilt of the switches is controlled by the position of the cup gear which adjusts the tension on the speeder spring.

Operating Adjustments

Due to the pondage capacity of the lake, it was impossible to set the interrupter slow enough to prevent "hunting" or "overshooting" when the float was controlled directly from the lake elevation. This difficulty was quickly and easily overcome by connecting the float chamber to the penstock inside the racks at a point where there was approximately 0.4-ft. head loss at full load. Such a connection made the device "self compensating." If the lake elevation rises 0.1 ft., indicating an increase in stream flow, the load control device immediately sends raise impulses until the load is increased to a point where the head loss through the racks and short section of penstock is equal to 0.1 ft. This returns the float arm to the neutral position and the impulses are stopped. If the lake elevation continues to rise, the device continues to send raise impulses until the turbine discharge is equal to the stream flow, or until the units are fully loaded. The reverse sequence takes place when the lake elevation falls. Thus there is a variation of 0.4 ft. in lake elevation between no-load and full load of the machine.

Such a connection also provides protection to the head racks against collapse due to excessive pressure when they become clogged with leaves and trash. As the racks become clogged, the head loss increases and the controller immediately reduces the turbine load until the head loss across the racks becomes 0.4 ft. or less.

Seasonal Settings

The float rod is connected to the float arm by means of a clamp. The rod is marked at three points designated as "lead"—"normal"—"lag." During the winter and spring months when the average stream flow is greater than the capacity of one turbine, the two controllers are set at the "normal" position and both units share the load equally. During the summer and fall months when the average stream flow is less than the capacity of one machine, one controller is set on "lag" and the other on "lead." The "lag" machine operates as a synchronous condenser for voltage regulation with the wicket gates closed and the draft tube vacuum broken. The "lead" machine carries all load until it reaches full gate opening; then the "lag" machine starts to pick up load. This arrangement provides more efficient operation since it eliminates the necessity of both machines operating at very light loads where the turbine efficiency is extremely poor. It does, however, cause the one machine to operate at a slightly reduced head, but the resulting decreased output is small in comparison with the loss due to the low turbine efficiency at light loads.

Operating Experience

These load adjusting devices have been in continuous operation for approximately two years. The only maintenance required is occasional oiling and the replacement once every six to twelve months of the interrupter mercury switch on the floating beam. This replacement is necessary due to a tendency of the mercury to sludge and become insensitive after a long period of operation.

A typical kw.-hr. curve of load increase and decrease (Fig. 3) after a short summer rain of 0.33 in. was made when one machine was operating at "lead" and the other at "lag."

A similar device with slightly different shaped cams is used to operate the Tainter spillway gates when the total discharge is greater than the desired discharge over the open spillway section.

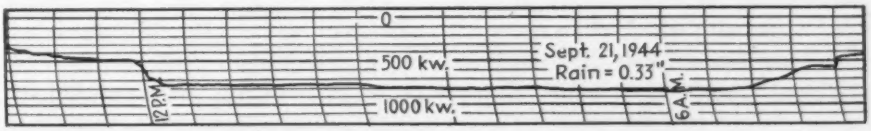

FIG. 3—Load automatically increased after short (1/3 in.) summer rain and subsequently decreased. Second machine picked up some of increased load

Standard Source Calibrates 60-Cycle Frequency Meters

Tuning-fork generators, portable if desired, with stable characteristics designed to verify system indicators and recorders to facilitate more precise control of tie-line interchanges

G. P. FALLON and C. H. FETTER†*

PROBLEMS of generation control, on individual systems, have been greatly increased by the necessity of providing proper regulation of power flow over interconnections and at the same time keeping the frequency deviation within a narrow band. An accurate indication of frequency in the various system load dispatchers' offices will designate which system should change generation, upon a variation of tie-line load, in order to restore the normal tie load and thereby reduce the amount of system frequency variation. Recent trends indicate a feeling among system operators that variations of as little as one-twentieth of a cycle can cause an appreciable change in tie-line loading.

Requirement of close frequency control has led to the development of both indicating and graphic frequency meters which can be read easily to within 0.01 cycles. Examples of these are the large frequency indicator installed in the Safe Harbor Hydro Plant** and the 59 to 61-cycle Leeds & Northrup recorder found in numerous generating stations. Each of these instruments uses scales whose smallest division represents 0.02 cycles and they are easily read to within one-quarter of a division or 0.005 cycles. Recorders have a guaranteed accuracy of calibration of 0.025 cycles (which is slightly more than one chart division). Recent tests, with which the writers are familiar, indicate that they duplicate their readings to within 0.005 cycles upon the repeated application of a constant frequency.

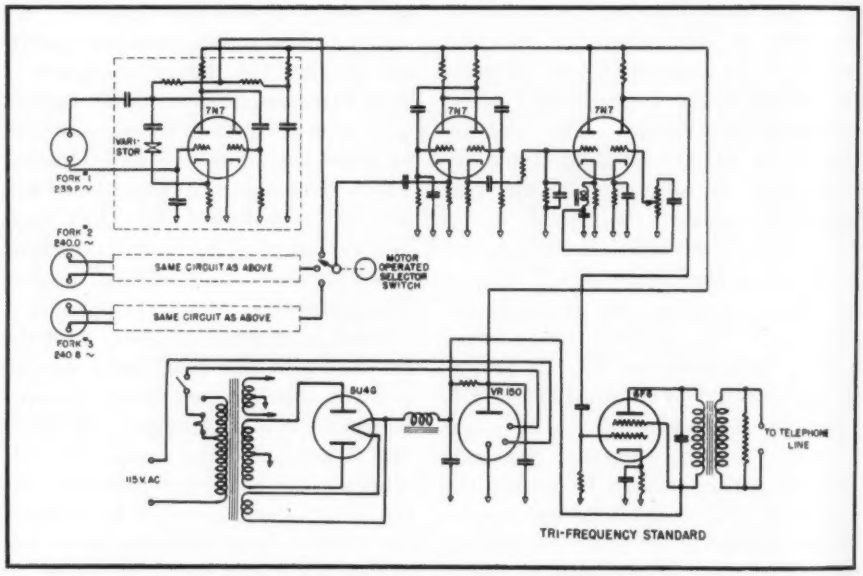

FIG. 1—Tri-frequency standard comprises fork amplifiers, motor-operated selector switch, multi-vibrator to convert to quarter-values and two-stage amplifier and filter

Obviously, if meters of this extreme sensitivity, used by the various system operators, do not give absolutely correct indications, neither tie-line loading, system time, nor instantaneous frequency can be controlled satisfactorily. These expanded scale meters have emphasized the differences that existed between the various stations. Therefore, the need for some convenient means of accurately checking and maintaining the calibration of the instrument has been increased. Various methods may be used for checking the accuracy of system frequency meters.†† Some of the better known ones are:

1. Rotating machines.
2. Temperature controlled crystal oscillators with several stages of multi-vibrators to reduce the frequency to 60 cycles.
3. High accuracy master clocks producing beats which are electronically converted to 60 cycles.
4. Radio signals from the Bureau of Standards converted locally to 60 cycles.
5. Tuning forks.

Standard Frequency Generator

All of the above methods have individual limitations such as size, weight, complications, atmospheric interferences, cost, etc. After careful consideration, it was decided that properly selected tuning forks could be arranged to give better than the required accuracy at moderate cost and with accompanying simplicity. A "Tri-Frequency Generator" was

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** ELECTRICAL WORLD, January 6, 1945, pages 54-56.

†† "Portable Frequency Standards for Calibrating 60 Cycle Frequency Meters" by S. K. Waldorf, Joint Report to Communications and Systems Operation Committees, Pennsylvania Electric Association, January, 1945, pp. 1-8.

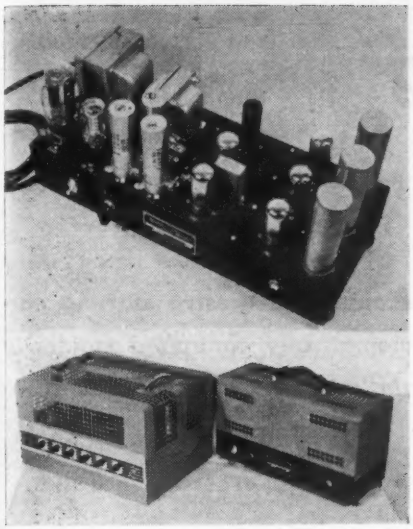

FIG. 2—Frequency standard (top) with cover removed and (bottom) alongside amplifier at left

developed by the Consolidated Gas Electric Light & Power Co. of Baltimore in cooperation with American Time Products Inc. This was then combined with the necessary amplifiers and filters to provide three standard frequencies of 59.8, 60.0 and 60.2 cycles for the calibration of all frequency meters on the Baltimore system.

Inasmuch as frequencies of this order require rather large tuning forks for stable operation, the actual fork frequencies used in the equipment are calibrated at 239.2, 240.0 and 240.8 cycles. Each fork is independently, electrically driven and the fork output is fed into an individual amplifier stage which utilizes a 7N7 tube to amplify the output of the electric pick-up coil. The output of each is selected in rotation at a pre-determined interval by a motor operated timer and fed into the multivibrator circuit. This is an electronic device wherein the frequency is divided by exactly four, in order to produce 59.8, 60.0 and 60.2 cycles. These frequencies are then amplified and filtered, and connected to telephone lines.

Stability and Accuracy

The frequency standard itself has an accuracy depending upon the tuning fork and its associated circuit. The tuning forks are of special alloy compensated to approximately one part in a million per degree Centigrade for temperature stability. Over normal room ranges and for power supply voltages varying between 110 and 120 and line frequencies varying from 55 to 65 cycles, the accuracy of the fork amplifier system is designed to be one part in 50,000. This is about four times the accuracy required to calibrate the sensitive instruments now used. Accuracy checks may be made on each fork by driving a telechron clock mechanism for 24 or 48 hours and noting the time deviation in seconds from time signals broadcast by the Bureau of Standards.

Wave Form

Output voltage up to 90 volts with a power output of one watt and a maximum wave form distortion of 10 percent can be obtained from the frequency generator. In practice, however, it is proposed to use only about 30 volts which will be applied directly to a telephone cable pair connecting to all the principal generating stations. At this level, the wave form distortion will not exceed 5 or 6 percent.

Wave form distortion affects the readings of all resonant type frequency meters. Experiments would seem to indicate that the accuracy of the meter indications is adversely affected when the total harmonic content of the supply exceeds 5 percent. Proper filters should be applied to the measuring devices so that the varying harmonic content of the supply system will not materially affect the indication. These same filters will be, of course, in the circuit when output of the frequency standard is applied to the frequency meters.

Initial operation will take place with a portable amplifier which will amplify the voltage received over the telephone lines and provide a power output of 70 watts at 115 volts. This amplifier will be carried from station to station when necessary by the meter testmen and will provide sufficient power to test any frequency meter, including its chart drive motor. Experience has indicated that it is necessary to energize the chart drive motor and the frequency measuring element from the same circuit. Otherwise, accuracy of indication is again adversely affected.

If, after a reasonable trial period, it seems desirable, a permanent amplifier can be installed in each station and the frequency meters tested at will by the station operator by simply pushing a button.

The accompanying charts indicate the frequency output of the three forks on 55 to 65-cycle paper and on 59 to 61-cycle paper, the latter being the master meter in the load dispatcher's office for which the high accuracy is required. The actual calibrating points; namely, 59.8, 60.0 and 60.2 cycles are those on which the highest accuracy is required. They are the points where corrective measures are taken if the system frequency deviation persists. If a system is not equipped with any meters having a scale range of two cycles, the frequency of the three forks would probably be chosen differently in order to check more carefully the instruments having a scale range of 10 cycles.

A synchroscope connected between the 60-cycle frequency standard and the power system gives a nearly instantaneous indication of frequency deviation. This can be used as a "fast" or "slow" indicator, but it can be of little practical value due to the constant slight shift of frequency in any system.

The 60-cycle frequency standard can also be used in combination with the system frequency to provide the system time deviation record. Space for this record is available on some Leeds and Northrup frequency recorder charts.

The standard can be used as the reference basis for a system time deviation indicator or integrator, both of value to system operators.

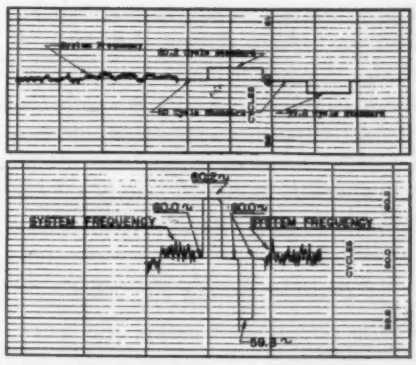

FIG. 3—Calibration of L & N frequency recorders by means of frequency standard. (top) Range 55-65 cycles equipped with harmonic filter: 115-volt source had harmonic content as follows: third, 2.8 percent, fifth, 1.6 percent, higher harmonics nil. (bottom) Range 59-61 cycles, equipped with harmonic filter: total harmonic content of standard frequency generator less than three percent at 115 volts

Motor Inrush Following Distribution Outage

Resumption of load after outage encounters excessive starting current because cycling diversity of automatically controlled motors is progressively lost—Tests and calculations show inrush of four to six times peak kva. for present circuit load saturations

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PRESENT SATURATIONS of automatically controlled, motor-driven appliances on distribution circuits are capable of occasioning inrush currents several times the pre-outage load when the circuit is re-energized after an extended outage. This can make difficulty in breaker-setting correlations, a difficulty that will be accentuated as the saturation of such starting loads approaches the increased predicted values. Involved are household refrigerators, water pumps, stoker motors, air-conditioners, sump pumps and fans.

Reality and magnitude of these resumption currents were confirmed by both test and calculation after trouble had been experienced in restoring a circuit which had suffered a 29-min. outage during the peak period. The over-current relay tripped the breaker and it was inferred that a short circuit had occurred. Several hours were lost in trying to locate the non-existing fault and finally the circuit had to be sectionaiized before reclosure was effective.

Breaker Setting Exceeded

The circuit in question was a 2.3-kv., 300-amp. delta-connected line serving 2,388 customers having 1,744 refrigerators and 295 water pumps. The current on reclosure, it will be shown, can reach four to six times the normal peak load and thus readily exceed breaker trip settings.

Loss of diversity among these motored equipments is the cause of the excessive inrush currents and any trend toward shorter operating-time cycles along with improved efficiencies would further aggravate the difficulty. This is due to the fact that, despite better running diversity, there would be greater loss in diversity on resumption after outage. Incidentally, one disturbing aspect of the situation is that there are no means to distinguish the early stages of the inrush current from a fault current of comparable magnitude.

Table I

Observed Load Kva. before and after a Minimum Load Outage

Load	Regulator Position	3:00 A.M.	3:30 A.M.	Percent
Normal (Min.)	Normal	271		100
Inrush	Neutral		2441	903
Inrush	Full boost		2821	1042
Inrush	Full buck		2070	764

Thus each 10 amp. of automatic appliance load, motors normally running one third of the time (off two-thirds) will, in a large group, contribute a diversity factor of three. With starting current of each at 500 percent the inrush current per 10 amp. of diversified motor demand will be $10 \times 3 \times 5 = 150$ amp. and this is 15 times normal. If running time is one-fourth, the inrush becomes 20 times normal. After an extended outage the devices will prolong their first operating cycle to "catch up" and there are indications that the current magnitude still be 15 or so percent high 15 min. after resumption.

Correspondingly high cold-starting current of incandescent lamps is not a factor in the tripping difficulty because it falls from some 800 percent within the first 0.1 cycle to 290 percent at the end of one cycle and is essentially normal at six cycles.

Special Inrush Test

During January the same circuit that had experienced the 29-min. peak-time outage during the preceding December was de-energized from 3 to 3:30 A.M. normally a minimum load period. From the data obtained on this staged test (Table I) the probable conditions for the earlier interruption or peak period were computed (Table 2).

In the interim one in each four customers on the feeder had been surveyed and thus it was estimated that there were 1,744 refrigerators and 295 waterpumps for the total of 2,388 single-phase customers. They are served by 188 single-phase transformers ranging in size from 1½ to 50 kva. In addition there are three 3-phase services, transformer sizes ranging from 3 to 10 kva. In making the current calculations for the 7 P.M. peak period is was assumed that each refrigerator motor takes 325 volt-amp. running and each water-pump 770. Lighting, radio, clocks, etc. were taken at a total of 277 watts per customer.

Currents and voltages were observed and power factor noted on the regulated side of each phase when the breaker was closed at 3:30 A.M. for one minute after the circuit had been de-energized for 30 min. Inrush current was measured for each of three

positions of the 10 percent induction regulators—neutral, maximum boost and maximum buck, in the order named.

The 2,821 kva. of 3:30 A.M. inrush load consists of 2,780 kva. for all 1,744 refrigerators starting, 30 kva. for transformer core loss and the existing 3-phase load and 11 kva. for lighting, clocks, radios, etc. The 1,048 kva. of 7 P.M. normal peak load (no interruption) consists of the following: one-third of the refrigerators, 211 kva.; three-fifths of the water-pumps, 137 kva.; transformer core loss and 3-phase load, 38 kva.; lighting, clocks, radios, etc. 662 kva. Each is based on the previously estimated unit values.

Actual tests revealed the following operating time cycles for refrigerators; 5 min. running as against 11 min. stopped to 19 min. running as against 39 min. stopped, the latter being the older types. If the running time is one-third the total cycle of refrigerator operation and the average on-period is 10 min., all 1,744 refrigerators will be ready to start after a 30-min. outage. Every 3 min. there will be 109.3 such units added to the diversified one-third (648) that are assumed to be running at all times. Of the 295 water pumps there will be 60 percent (177) running all the time with 11.8 starting and quitting every 3 min. These together build the peak load kva. from 1,048 to an inrush value of 4,425 at the end of 30 min. These (and the intermediate 3-min.-interval values) were computed, taking into account the voltage gradient. Low voltage, due to inrush current drop near the source, limits the starting current of remote motors until the voltage along the circuit has recovered. However, the overall effect of voltage gradient accentuated by the inrush currents is more to prolong the starting period than to diminish the crest values.

Table II

Calculated Load Kva. before and after Peak Load Outage

Load	Regulator Position	6:30 P.M.	7:00 P.M.	Percent
Normal (Peak)	Normal	1048		100*
Inrush	Neutral		3828	364
Inrush	Full Boost		4425	422
Inrush	Full Buck		3240	310

* Actual load as recorded by the sub-station graphic instruments immediately before the December outage.

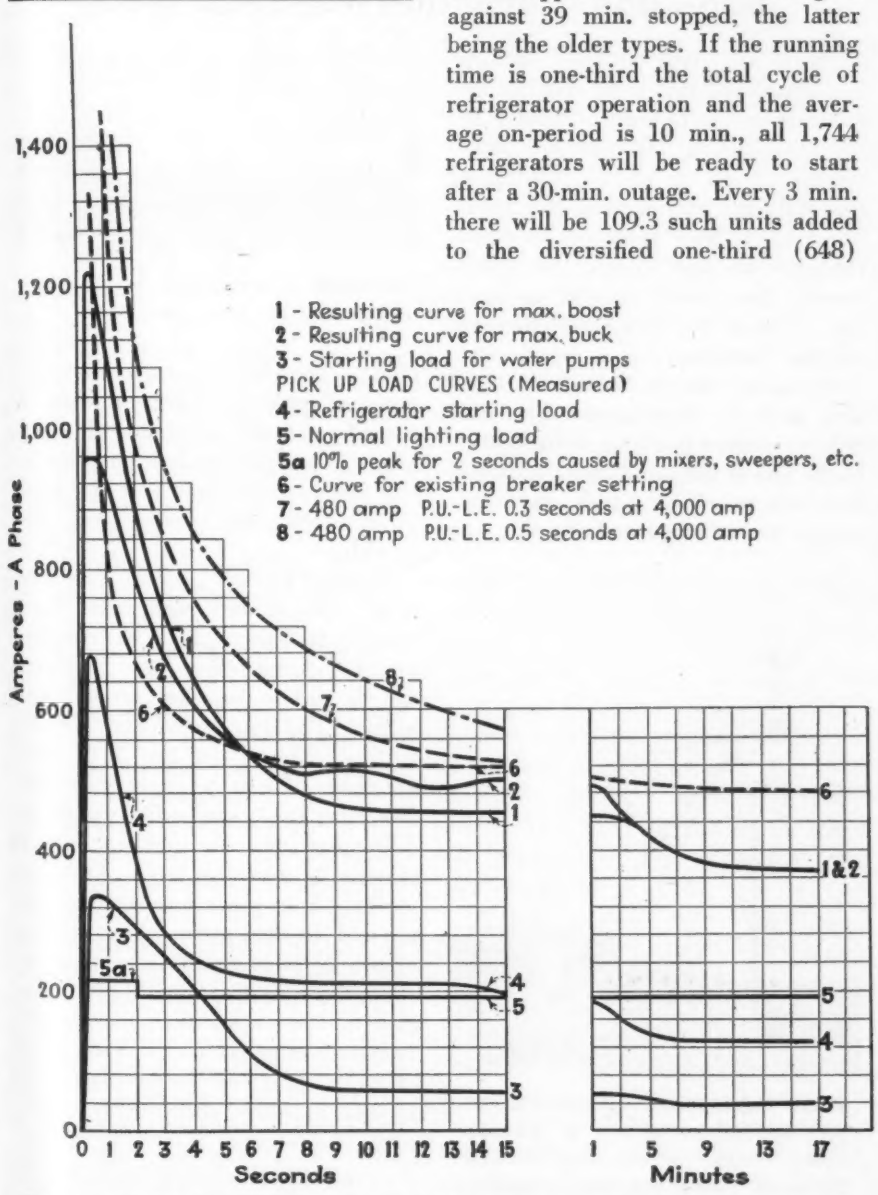

1 - Resulting curve for max. boost
2 - Resulting curve for max. buck
3 - Starting load for water pumps
PICK UP LOAD CURVES (Measured)
4 - Refrigerator starting load
5 - Normal lighting load
5a 10% peak for 2 seconds caused by mixers, sweepers, etc.
6 - Curve for existing breaker setting
7 - 480 amp P.U.-L.E. 0.3 seconds at 4,000 amp
8 - 480 amp P.U.-L.E. 0.5 seconds at 4,000 amp
Amperes - A Phase
1,400
1,200
1,000
800
600
400
200
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Seconds
1 5 9 13 17
Minutes

FIG. 1—Calculated starting currents on 2.3-kv., 300-amp., delta circuit after 29-min. outage; average normal load 260 amp. per phase. Resulting inrush current exceeded the breaker trip setting thus reopening the breaker when service resumption was attempted. Less inverse curves are shown for low-energy type relays which would have allowed the breaker to remain closed during the inrush current condition following the 29-min. outage

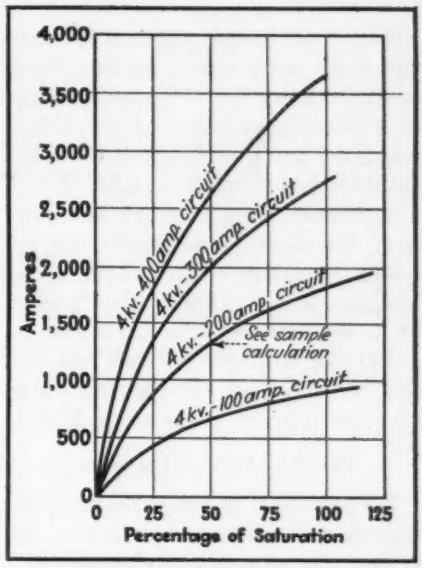


FIG. 2—Inrush currents for partial and full saturation of automatically controlled motor-driven appliances. Customers demand is assumed 350 watts of lighting and one-third of connected motor load normally operating. For full saturation, the assumption is 1.380 volt amp. per customer automatic motor load, plus 350 watts of lighting following an extended outage

Relay Trip Factor

Explanation for the inability to keep the breaker closed in resuming service after the 29-min. December outage is found in Fig. 1. This has been drawn from the January test data summarized in Table 1 with adjustments for phase averaging, etc. The inrush current curve lies to the right of the curve for the breaker-relay as set, from immediately after the crest to nearly 6 sec. after closure. This is true for both maximum boost and maximum buck positions of the regulators.

Decay of inrush current is such that some such relay characteristics as those shown for 480 amp. pick-up of a low energy relay set for either 0.3 or 0.5 sec. would appear to be required to have kept the breaker closed when reenergizing after the interruption. It is desirable to employ any relay characteristic which would, as in this case, allow 1,000 amp. to persist for 2 sec. and 850 amp. for 3 sec. on a 300-amp. circuit. At least not unless other means of clearing fault currents of lower value are provided.

Possible Future Inrushes

If saturations of automatically controlled, motor-driven equipments are to increase as predicted for the post war era, consideration will manifestly have to be given to the factors which have been cited. As saturations increase, the inrush values increase in the manner indicated in Fig. 2.

Present average demands of 325 to 400 watts per customer are typical (750 watts perhaps being more representative where dwellings are large or the residential section is rated high-class.) Assuming 800-watt demand for the prospective general average, there is coverage for 350 watts of working lighting load and 450 volt-amp. of automatic motor load (one-third the connected automatic load). Test and survey data indicate that present saturation on the particular circuit in question was only about 25 percent.

Suggested Measures

A relay characteristic less inverse has already been mentioned as a possible means of meeting the problem created by inrush currents following outages. This is far from an ideal solution. The following alternatives are offered for consideration. Study is being given toward developing feasible characteristics of the first item enumerated.

1. Installation of automatic sectionalizing switches having time-delay characteristics which would apply sections of load at successive time intervals when re-establishing service after an outage.

2. Installation of manually operated sectionalizing swiches, dividing the circuit into several sections if difficulty is encountered at restoration, reclosing the switches successively; thus gradually applying sectionalized load to the breaker as the high inrush currents are reduced.

3. Installation of tie switches coordinated with sectionalizing switches to pass part of the inrush current load to other normally operating circuits having the requisite capacity.

4. In attempting resumption after an outage, it is advantageous to put regulators in maximum boost positions because the inrush current period is shortened if the voltage is higher.

5. Restriction of circuit loading within assigned inrush current limits so as not to exceed permissible breaker trip settings.

6. Any available auxiliary bus in the sub-station can be used directly (bypassing the breaker) until inrush current has been reduced to tolerable limits. Usually an undesirable move.

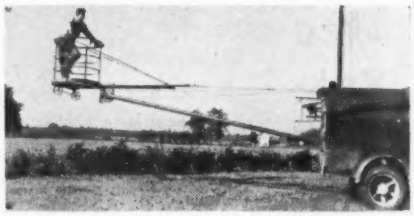
7. Application of a primary network for the sake of its inherent capability of distributing high inrush currents among several breakers when service is re-established following a sectional interruption.

• • •

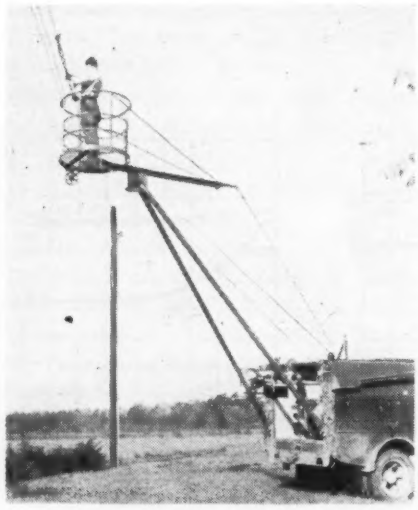
"Bird-Cage" Facilitates Mid-Span Work

"Bird-cage" type working platform has simplified mid-span splicing operations on the Delaware Rural Electric Association (Greenwood, Del.) system. Previous to the making of this platform when a conductor break occurred, it was necessary to climb the poles on both sides of the break, remove the tie-wires, lower the conductor, make the splice and then resag the conductor.

By using the platform, much of this work is eliminated. The gin-pole supported platform is backed up to the line at the break, the conductor ends are raised by handlines, come-alongs are attached and the splice is made. The platform usage has eliminated all pole climbing, tie wire removals and the necessity of resagging. It has also made it possible for one first class lineman and one grunt to complete the joint, easily and quickly.



LINEMAN is transported in the cage when jobs are near each other



FIRST CLASS lineman elevated to correct position for making a mid-span splice. "Cage" is raised and lowered by winch power and floor is always level since "cage" nose piece and truck floor form two sides of a parallelogram. The other two sides are formed by the gin poles and the guy wire which is attached to the nose piece tip and a hook on the truck floor

Norbert Porter, general line foreman, devised and made the "bird-cage." It has a floor of window-guard wire-grating to minimize weight and to increase ground visibility. The top guard rail and the vertical supports of the 3½-ft. cage are made of 1-in. wrought iron pipe. The other two guard rail supports are ¾-in. pipe and the bottom support is made of 3-in. tire iron. Two ½-in. wrought iron pipes between the cage top and the nose-piece, which is made of two 2½-in. angle irons, serve as tie-rods. The nose tip is made of a 2½-in. pipe and has a stabilizing cable permanently attached to it. Two pieces of 12-in. by 15-in. boiler plate serve as the gin-pole attachment. Eight-inch wheels make it easy to roll the platform out of the garage and attach it to the truck.

The platform proved its worth during the recent hurricane in removing the tree tops which were tangled up with both primaries and secondaries as well as in making the splices.

Speed, Load Control on Interconnected Systems—VI*

Nature and source of tie-line swings and necessary amount of regulating capacity—Its incremental cost and use—Test programs for automatic load control—The case for automatic combustion control

E. E. GEORGE, Electrical Engineer, Ebasco Services Inc., New York

TIE-LINE SWINGS occur because there is not an exact continuous balance of load and generation within the systems at each end of the tie line.

Changes in frequency do not affect all turbines alike, because all governors do not have the same incremental slope. Therefore, there is a continuous trading of load between units, plants, and systems. Such swings are a small percent of tie-line capacity, have a period of only a few seconds, and often damp out after several oscillations, if conditions are favorable. "Favorable conditions" include such items as small dead band, uniform overall slope, stable incremental slope, and frequency regulation within a few hundredths of a cycle.

The most important and most general cause of tie-line swings is a change in customer's load. On large interconnected systems this type of change is large enough to necessitate tie-line load control.

In studying tie-line load control, the first thing is to make a distinction between two classes of regulating requirements. One requirement is to meet the gradual change in load in the same direction for a considerable period of time, thereby following the estimated envelope of the daily curve. Such changes can be handled to some extent as scheduled block changes on the higher cost steam plants. This type of regulation works in well with the usual practice of loading and unloading plants on an economy basis as determined from incremental cost. The use of automatic load control should not affect this class of regulation except to facilitate it by automatically correcting errors in estimating.

The second class of regulation is the handling of the small recurrent, unpredictable swings of a few seconds or a few minutes duration together with other deviations from the estimated envelope of the load curve. This "fringe" regulation cannot be foreseen in time to be handled by block changes, and can be handled satisfactorily only by plants with high speed automatic control.

Rate of Change of Customers Load

An extensive survey in 1940 of load changes on most of the large systems in this country showed maximum normal load changes of 1 to 20 percent of system peak load within 15 min., with 4 percent in 15 min. as a typical maximum value. On this basis the maximum change in 1 min. might be 0.25 to 5 percent of the system peak load, with 1 percent per min. as typical.

On some of the Southern systems, the summer night peak increases 2 or 3 percent per minute.

Typical or average figures like the above may be interesting, but the value for any particular system can and should be determined by test. Fairly good load-shape envelopes can be determined by reading all plant and tie loadings every 10 min. More frequent readings or analysis of charts are desirable during periods of rapid load change.

Amount of regulating capacity required in a given period of time is of course equal to the change in total of all customers load during that time.

It is obvious that "fringe" regulation should be taken on hydro whenever possible. Use of storage hydro for regulation purposes during a large portion of the year is usually taken for granted when such systems are operated in coordination with steam systems.

If these "fringe" swings are taken on several plants or units simultaneously, the change in load on any one of them is very small and the effect on efficiency would be small, even for a hydro unit operating on the crest of its efficiency curve. Whatever loss there is in plant economy must obviously be balanced against the advantages of interconnected operation.

In the past, it has been customary to assign one unit to take the small changes over a period of several hours, and to keep that unit within range by block changes on other units in that plant and other plants.

If a block change can be made as frequently as every 15 min. if needed, an average figure for the plus and minus range of the regulating plant for a large diversified area might be 5 percent of peak load.

Sharing at Regulation

Most automatic load-control equipments provide for using all or most of the units in the regulating plant simultaneously. If proportional loading equipment is not used, manual equalization between units is required every 5 to 30 min. (to correct for differences in synchronizing motors, governors, and turbines).

Two machines of the same characteristics operating in unison to con-

* This is the last of a series. Previous instalments: I—March 17, 1945, page 84; II—March 31, 1945, page 96; III—April 28, 1945, page 82; IV—May 12, 1945, page 105; V—September 15, 1945, page 96.

trol swings, will each have less than one half the load change of one machine trying to do all the controlling. With two machines control will be faster and total variations will be less.

With automatic load control two or more plants are often used simultaneously for regulation. Ordinarily this requires an extra carrier frequency, and a proportional loading controller.

On large systems equipped with automatic tie line load control, there is a trend toward increasing the number of units and plants regulating simultaneously. On account of the cost of control equipment, only large plants can be equipped with electrical control. The plants with electrical control are seldom the plants with the highest incremental cost during all hours of the day. Accordingly, there must be a compromise between cost of electrical control equipment, cost of combustion control equipment, incremental energy cost, and tie line capability in planning and operating regulating plants.

Incremental Cost of Regulating Capacity

Determining the best method of providing regulating capacity is a problem not easily solved and it seems likely that the specific answers will not be the same for any two control areas owing to differences in proportion of steam and hydro available, differences in relative incremental cost of operating base load and peaking units and differences in *quality* of regulation required.

Primary reason for spreading regulation over a number of units, either by governors or by supplementary automatic control, is to obtain the smoothest possible regulation of frequency and tie-line loading. Conversely, the primary reason for concentrating regulation at one plant and perhaps on one unit is to obtain maximum economy. The problem thus becomes one of striking an appropriate balance between the value of "quality of regulation" and the cost of providing regulation of various qualities. It will be appreciated that in the case of certain systems, there are normally operating plants which have incremental fuel costs as much as four to one compared with their modern plants. It is, therefore, imperative that a careful study should be made to determine the best economy obtainable with the appropriate regulation that is required. Few tests have been made to determine relative cost of taking the short time load swings on many or all plants instead of on a single plant. Such tests under actual operating conditions would establish sound policies in planning appropriate regulating capacity. It is believed that the loss in changing from one load to another is small and the differential between these losses for a large change over that for a number of small changes is small.

Satisfactory Schedules

In the normal case in which tie lines are not loaded to their maximum carrying ability the primary function of regulating equipment is to maintain power interchange at an average value which is close enough to the schedule to be mutually satisfactory to the parties directly concerned. The second but almost equally important function is to maintain instantaneous values of frequency and of power interchange which are sufficiently constant to avoid originating system power swings. These power swings may have adverse effects upon other tie lines and may ultimately cause system separations or wide frequency deviations.

Quality of regulation required to satisfy this last condition is not uniform nor can it be predicted in advance. Careful analysis of actual operation seems to be the best answer. In the course of such analysis it should be borne in mind that elimination of critical bottle-neck points may well be more economical in the end than the imposition of exacting load regulating requirements upon the whole interconnected systems.

When an individual line is loaded to capacity, the problem is different since the tie line, in a sense, becomes a base load unit on which it is desirable to maintain the highest possible average load.

Rate of Use of Regulating Capacity

There is no particular problem in providing fast regulation on hydro systems if the variable use of water is permissible. A hydro unit can be brought up to normal speed and full load from stand-still in a few seconds.

On steam systems there is an extremely wide variation in conditions. The upper limit of high speed change on a steam plant probably occurs in steam standby stations with units floating on minimum steam (2 to 5 percent of rating). Such units sometimes pick up load to 100 percent rating in a few seconds. Steam pressure falls 10 to 20 percent and is restored to normal after 10 or 15 min.

In contrast with such special situations, a conservative approach to the average situation is illustrated by recent published statements of manufacturers.

In 1942 one of the major turbine manufacturers held a conference of its turbine engineers to discuss allowable regulating duty for modern steam turbines. Conclusions of this conference are as follows: "A plus or minus 75 deg. F. change in internal temperature, either sudden or cyclical around a mean temperature, will not cause serious strains or clearance changes. . . . However, the maximum temperature reached must not exceed the contract limits both as to duration and intensity. . . . An effort is made to design all turbines so that in cases of necessity they can drop all load instantaneously without damage, or pick up full load from no load as fast as dry steam can be supplied. . . . Except when special circumstances alter the situation, we know that the most sensitive of the above machines have safely withstood the temperature changes incident to a sudden increase from zero to full load or of a sudden loss of full load. We do not know how many times in the life of a machine it can be safely put through such drastic changes in temperature without increased maintenance being required. In the case of temperature changes in excess of 75 deg. F., it would appear desirable to allow some time for the change to take place."

Abrupt Load Changes

On the foregoing basis, this manufacturer would prefer to limit sudden changes in load to 25 percent of rated load with constant initial steam temperature. Slow continuous changes would be limited to 2 percent per minute with constant initial steam temperature for 1,800 rpm., single shell turbines. This would allow a change from minimum load to full load in 50 min. for such units.

The preceding suggestions of a turbine manufacturer are perhaps more conservative than the "1,000 kw. per unit per minute". Many plant men take refuge behind this latter phrase.

The ancestry of this phrase is clouded in obscurity, and its legitimacy is just as doubtful.

Nowadays it is generally recognized that every operating engineer, electrical or mechanical, should establish proper ratings for his particular conditions, and not rely blindly on nameplate capacities, even though nameplate capacities are based on conditions fought out long ago between users and manufacturers. The users have seldom been heard in the matter of rate of change of load, and the manufacturers have largely been content to take a natural and very conservative position—one that would minimize operating problems and avoid any real tests.

Therefore, it is not surprising that progressive mechanical engineers have sometimes adopted rates of change much higher than the manufacturers suggest. Such progress usually involves analyses of difficulties, systematic tests, and minor changes in facilities. A typical example is that described in the ELECTRICAL WORLD of October 14, 1944, where the addition of baffles in the feedwater heater raised the permissible rate of change from 2,000 kw. per min. to 20,000 kw. per min. on an 80,000-kw. unit.

Operational Tests of Regulating Capacity

There is nothing quite so effective in overcoming arbitrary operating practices as an intelligent test program. As one operating superintendent states: "The practicable rate of load change will depend upon the operating characteristics of the individual turbine installation, the water storage of the boilers, the maximum capacity of boiler air and fuel supply, and the speed with which fuel and air may be safely brought to maximum. *Many of these factors are determined only by cautious operating trials starting with low values of pick up and gradually increasing the load acceptance as the suitability of equipment and skill and confidence of the operating forces is demonstrated.*"

System tests are an essential part of the installation of automatic load control. The larger the group of interconnected systems, the more important is the test program. That this fact is not sufficiently appreciated is indicated by the following extracts from letters written by manufacturers engineers to their clients:

"It has been our experience in many cases on interconnected systems that each controller is considered as an isolated installation with a definite tie line to control, and a certain group of generators on which to regulate. This attitude may be of little consequence when only one or two controllers are in service on a large interconnection, but as soon as several controllers are used on neighboring systems that operate interconnected, the situation is entirely different. The various load controllers must be carefully coordinated to be sure that the regulating effort of any one system is not opposing that of another system. As one example of this condition, we might consider what happens to the contribution of one system operating under tie-line load bias control when this contribution must flow over another tie line that is controlled by a second system operating under flat tie-line load control. It is quite apparent that the second system only wipes out the contribution of the first system. Another example of this condition is the result caused by having an abnormally fast rate of correction on one system when a neighboring system has a relatively slow response to load deviations. In this case, the first system has a tendency to grab more than its share of the regulation, a part of which must ultimately be transferred back to the slower system, thereby causing an additional load swing over the intervening tie."

Basic Test Results

"1. What is the magnitude and rate of change on the ties to be controlled by a selected area?

"2. What is the magnitude and rate of response of the regulating plants to be used to hold these ties on schedule?

"This seems fairly straightforward and certainly fundamental. It is obvious that if the changes in generation cannot be made as fast as the controlled quantity deviates, there is not much hope of maintaining the schedule regardless of automatic control."

These tests may be broken down into several relatively simple procedures, as follows:

1. To determine amount, linearity and constancy of response of each governor to its synchronizing motor control, throughout its full operating range.

2. To determine typical system load curve, including short time maximum, short time minimum, maximum rate of load increase, maximum rate of load decrease, etc.

3. To determine incremental slope (or incremental regulation) of each governor, throughout its full operating range.

4. To determine time required for system governors (all operating simultaneously) to correct load changes under one or more typical conditions.

5. To determine the sensitivity or dead band of each governor at its normal operating point.

6. To determine inertia characteristics of rotating equipment (utility and customers' equipment).

7. To determine torque characteristics of rotating equipment (utility and customers' equipment).

8. To determine ability of regulating plants to hold flat frequency (this provides a check on governor adjustments and maintenance, and also insures good operation during emergencies when the system is separated from its interconnections).

Of the above eight items, the first two are the most important. The next three are clearly needed. The next two tests provide information of great value in the present state of the art, but they are seldom made because they require blocking of governors. There is no excessive difficulty or hazard in blocking governors, but most operating men who haven't tried it shy away from the idea.

Automatic Combustion Control

Although mechanical engineers and power plant supervisors are still arguing over the merits of automatic combustion control, it may be of interest to note that automatic load control may well be as leverage to sell automatic combustion control in situations where it has previously been resisted. Electrical men generally favor automatic combustion control, particularly after seeing it tried out at regulating plants. Boiler room supervisors, and even the firemen themselves, frequently welcome it to offset the increase in time and effort required to follow system load changes.

Helpful assistance and contributions of utility engineers in the Southwest, as well as associates of Ebasco Services Inc., in preparation of the six articles herewith concluded are hereby gratefully acknowledged.

Editorials

S. B. WILLIAMS, *Editor*

Can't Avoid the Responsibility

LAST SPRING manufacturers began to turn from "imagineering" to actual preparation for production of peacetime goods, from dreamy contemplation of surveys prophesying post-war markets to the lining up of distribution channels. Since that time hardly a week has passed, that has not brought to ELECTRICAL WORLD a report of some new entry into the appliance business or a request for information in person or by mail stating or indicating such intention.

A complete listing of manufacturers of electric appliances, made six months or a year from now, would, we are sure, be long and would contain a lot of unfamiliar names. And another complete listing, made five years from now, would, we are also sure, be much shorter because of the disappearance of many of those unfamiliar names, and possibly of some familiar ones, too. The making of electric appliances looks profitable and it is attracting all kinds of enterprisers, stayers and in-and-out'ers.

As it is in the making of electric appliances, so also is it in the selling of them. From present indications it may not be too dreamy to imagine the lady of the house being urged to buy a new refrigerator as she sits under the tentacles of the permanent wave machine in the beauty shoppe, or her husband being tempted to invest in a radar-controlled toaster when he stops in the corner tavern for a beer on his way home from work. Such is the diversity of shops and stores that have said they intend to sell electrical goods.

Relying for load-building results on an expansion of electric appliance manufacture and distribution, a considerable number of electric utilities have decided to retire from merchandising. That is easily and simply done; all that is necessary is to stop selling appliances. But not so easy and simple will it be for a utility, if any were to try, to retire from responsibility for the quality and performance of appliances its customers buy. As was indicated some makes of appliances will become orphans and with the influx of a heterogeneous set of dealers there are bound to be many who will refuse to carry their proper service burden. Then, for the two reasons of customer satisfaction and of retention of load, the utility will be forced to take measures to keep the affected devices in operation. And, whether or not the customer pays for repair service, the responsibility will impose a definite cost on the utility.

Return to Standard Time

WARTIME, which has been in effect for nearly four years, has ended and the country now returns once more to standard time. To some utilities situated on the wrong side of the time zone the sudden load which this will throw on the system may be embarrassing, but in general the change can be accommodated with little difficulty.

Operations may be expected to change back to the customary pre-war evening peak and, of course, the output will reflect greater use of lighting kilowatt-hours.

During the war this continued daylight saving did help to hold down the demand on manufacturers for additional generating units and also played its part in fuel conservation. However, though many estimates were made, it is doubtful if it will ever be possible to know for sure just what the savings were.

This was the last of the customer restrictions, all the others—dimout, brownout, curfew—having been lifted earlier. The utilities are now back to civilian operations and can plan accordingly. The loss of good revenue load was considerable, but it was accepted without complaint. Where it does not place a strain on capacity its return will be welcome.

Back to Basics

TWO THINGS have been happening recently which ought to pose to electrical engineers the question "should I keep on neglecting my knowledge of physics?" The recent furor over the atomic bomb is one and the rising interest in non-radio electronics is the other.

Engineers proverbially have looked upon the college physics course as a necessity to be tolerated rather than an opportunity to be embraced. So many of them have the practical bent that they chafed at acquiring the fundamentals of physics, feeling that the time devoted to their absorption was just so much delay in getting started on the engineering they envisioned. Electrical professors have often been conscious of this attitude on the part of their students, not infrequently urging the physics professors to mold their presentation away from the academic angle so as to "make it more practical."

But electrical engineering, as such practically minded engineers have conceived it, is undergoing change. At every turn there is the prospect of, at least, having to consider electronic alternatives to conventional procedures, before long if not soon. Atomic energy is

much less imminent but when it comes in full swing it will cause some profound changes in the field where familiar electric systems serve and compete.

It goes without saying that a sizable fraction of the early crop of new engineers should refrain from taking the attitude in which their fathers viewed the physics courses of their day. It will bear saying, however, that some of the fathers could well refresh themselves in those very fundamentals of atomic physics for the sake of acquiring a grasp of electronics and the very new (to engineers, at least) field of neutronics or nucleonics. New terms? Yes, because atomics has to do with chemical interactions in which the atom is intact and in no sense disrupted. Disrupting the atom for the sake of access to its bound energy is a different matter of using neutrons to divide the nucleus—hence the possibility of either term supplanting the term "atomics" in discussion of energy release.

Lest anyone get the idea that the physicists have surrounded their discoveries with a wall of incomprehensible terminology and hocus pocus, the suggestion is offered that the engineer read Professor Smyth's report on "Atomic Energy for Military Purposes." It is lucid and simple. It shows that the physicists have emerged from their sanctums to make an intensely practical contribution. It should show, also, that the engineers had better meet them half way if the engineers are to hold their place in the future pattern of power as applied for man's benefit in an era of peace.

Utility Fire Fighting

ALTHOUGH ELECTRICAL EQUIPMENT is generally so well designed and maintained on utility systems that fires are comparatively few, when they happen they are prone to be serious because of the vulnerability of apparatus insulation and wooden structures to undue heat and flame. Some utilities have a well defined program based on critical analysis of their needs and what is available to meet the unique requirements, but there are others who apparently have been lulled into a feeling of complacency because they have never had a fire of any consequence.

But things do fail and mishaps do happen. Compatible with the cost of an outage in terms of public relations as well as customer loss in terms of production there is an amount which should be devoted to fire extinguishment in addition to fire prevention. It will probably be found that the cost is such as to be wholly secondary if the results are effective. And effectiveness means that service is not interrupted and that exposed quipment can be put back in service immediately.

Just what is best suited for each different hazard is a matter of judgment, of course, but that judgment is more confident if based on facts. Facts needed cover a wide range. What effect does the extinguishing agent have on electrical apparatus? Can outdoor demonstrations be trusted to be indicative of indoor conditions—a breaker aisle, for example, in confined space? How much of the agent has to be on hand for the back-up? Does it spoil, corrode or evaporate? What are the electrical conductivities of streams and sprays (despite the published information there is a call for more)? What educational programs are needed to get results from employees who encounter only one fire in a lifetime? What about the replenishment and upkeep of the equipment? Are hoses durable?

An engineering handbook for men who are not "fire-eaters" would be helpful—probably more so than spectacular demonstrations under staged conditions. It should answer the above questions and many others. From the knowledge acquired the utilities would not only protect their own facilities but they would be able to help many a volunteer department to learn that, with effective and safe equipment and methods, fires can be mastered without de-energizing all the wires and equipment in the immediate vicinity.

The Trend of Output

ONE OF THE most interesting things we print in each issue is the weekly output curve. It is the indicator of the economic trend of the industry and as such helps many people to make decisions of one kind or another.

Right now there is considerable speculation as to where the curve is going to settle down. Some estimate that weekly figures in the next six months may seek a plateau as low as or even lower than 3.5 billion kilowatt-hours a week, while others estimate well in excess of 4 billion kilowatt-hours a week.

Since V-J Day the curve is decidedly saw-tooth due to Victory holidays and Labor Day. This week it is again down, probably because of loss of factory production due to strikes. However, it would seem likely that as soon as the strikes are over and people go back to the jobs that need filling, there will be few weeks when the output dips appreciably below 4 billion kilowatt-hours. If that be true then the 1945 output should not be very much below that for last year and should run well in excess of 200 billion kilowatt-hours. In a couple of weeks the return to standard time should have some effect and by next spring the progress in reconversion should cause another upward trend so that 1946 may surpass 1945.

The manner in which the curve has held up has been amazing to a great many people. The reductions in output have been of the order of less than 10 percent. If it is true that the output curve is an accurate barometer of the trend of American business then it would appear that the transition from war to peace is not as disruptive of our economy as many people expected. It also gives great promise that our ability to maintain a national income on the scale to which we have become accustomed is not the figment of just our imagination.

WASHINGTON COMMENT

By R. N. LARKIN, Washington Correspondent

FPC Has Its Own Reconversion Problems

THE FEDERAL Power Commission finds its passing from war to peace complicated and momentarily delayed by a transition from the commission that was to that which is to be.

Not only must the Commission acclimatize two new members, but it must select a chairman and a general counsel, replace important employees, obtain and analyze considerable data on war-born power system interconnections and accelerate promptly its deferred peace-time work on original cost determinations, licensed projects, statistics and publications. It must do all this while controlling its potentially explosive natural gas investigation.

Little delay is anticipated in the qualification of Richard Sachse and Harrington Wimberly, the new commissioners. Sachse is known to have some close-out duties which might prevent his taking the oath before October 15. It seems a wholly reasonable assumption that there will be no Senatorial delay in confirmation which would retard matters beyond that date.

Task of Electing a Chairman

Probably one of the first tasks the new Commission will assign itself is the election of a chairman. Men who know the Commission well refuse to speculate on the identity of the new chairman, but agree that the situation is one such as has never before been faced.

Commissioner Olds, who will become acting chairman October 1, has been chairman only recently. Informed observers point out that the job carries with it responsibilities which a veteran very conceivably might be reluctant to assume. Conversely, because of his experience and his admitted capabilities, Olds is a very logical choice.

Commissioner Draper, another veteran, is beyond the age at which many men retire. For this reason, some feel he may be a less logical choice than he otherwise would be.

Commissioner Smith, although a relative newcomer, has served FPC two years and has an extensive regulatory background, including service on and chairmanship of the New Hampshire Public Service Commission. No rule or tradition bars a Republican from the chairmanship during a Democratic administration; so Smith is a logical possibility, although his supervisory assignment on the gas investigation might make unwelcome the additional burdens of the chairmanship.

As to the newcomers, the unique situation facing the Commission still obtains, for never has more than one member joined the Commission with the chairmanship vacant. Sachse, despite his lack of service in federal regulation, is a veteran of the California Commission, both as a member and as its chief engineer. Wimberly, although he comes to the Commission with imposing recommendations from within the Commission and from Capitol Hill, seems not to be an outstanding candidate for the chairmanship in the absence of any known regulatory experience.

General Counsel Possibilities

Of perhaps equal importance will be the Commission's choice of a general counsel to replace Charles Shannon, who resigned recently after an imposing record of major legal victories which constitute some foundation stones of FPC's regulatory position. Having no attorney members, the Commission will need extra diligence in its choice. It must somehow find a $50,000 lawyer who will, for the $9,800 salary, prevail against the best attorneys the electric and gas industries can command.

Three attorneys now with FPC, all highly regarded by Washington lawyers, are logical candidates. They are Harry S. Littman and Howard E. Wahrenbrock, assistant general counsels in charge of gas and electric matters respectively, and George Slaff, chief FPC counsel for the gas investigation. Littman is reported to be about to leave FPC, although informed observers figure his chances the best of the three. These same observers indicate the belief that the Commission will ultimately name a general counsel from without the present organization. Chairman Robert Hannegan, of the Democratic National Committee, is reported by responsible sources to have interested himself in the matter.

There is some possibility that Mr. Truman may have a third appointment to make next year when Commissioner Draper's term expires, which would leave only Mr. Olds of the pre-war commission.

Operating Problems

As promptly as it can, FPC hopes to get into high gear on the completion of its original cost work, most of which has been finished. It has more than 600 licensed project cases, some of which will and some of which won't lend themselves to "mass production" settlement. In this connection, some responsible observers anticipate more "negotiated" settlements requiring no litigation. They cite the many basic court victories of FPC and the departure of Lawyer-Commissioner John Scott as reasons why there may be less litigation.

Regarding war interconnections, FPC wants to be able to advise on which should be retained after certificates of war exemption expire. Its power-marketing studies, ultimately to cover the entire country, will be required for future stream development legislation and for any desired "shelf" of public works projects.

Depreciation will be a problem for FPC consideration. Since state commissions are concerned with it as well, FPC action thereon might repair or further rupture its currently strained relations with state groups. It could also be a problem within the Commission, since Member Nelson Smith and Chief Accountant Charles W. Smith, each an expert, holds views on the subject which do not always coincide.

NEWS OF THE WEEK

FPC Nominees Will Face Senate Commerce Group

Wimberly and Sachse Will Be Heard October 2—House Committee Reports Favorably Bill Giving Truman Power to Reorganize Executive Department Including FPC—MVA Bill Opposed before Committee

Harrington Wimberly and Richard Sachse, nominees for the Federal Power Commission, were to appear before the Senate Interstate Commerce Committee, October 2, in connection with their confirmation by the Upper House, a committee attache told ELECTRICAL WORLD this week.

In the continued absence of any opposition to their nominations, it was anticipated that the committee would not hold hearings but would report the nominations favorably after meeting.

Meanwhile, FPC appeared to be mildly on the spot after a House committee reported favorably a bill giving President Truman authority to reorganize the executive department, for FPC was not exempted from its powers, as were the Interstate Commerce Commission, the Federal Trade Commission, and the Securities and Exchange Commission. While the bill has a long, rocky road before it on the House floor and in Senate committee and on the Senate floor, the fact that it was reported in the House without exempting FPC was a setback of some proportions to those interested in seeing the agency remain independent.

It was widely agreed that President Truman would not have objected to exemptions for regulatory agencies if he had not intended to subordinate them to a Cabinet officer. The Interior Department was regarded as the most likely landing place for FPC if it were to be required to report to the President through a Cabinet officer.

One observer close to FPC, however, advanced the opinion that sentiment for more regulation of Interior's power projects rather than less is entirely too strong to allow FPC's regulatory functions to be put in a department which also contains agencies regulated by FPC.

As reported, the bill amounts to a vote of confidence in President Truman, since it gives him, with relatively minor exception, the authority which the late President Roosevelt was never able to command. Furthermore, the authority to shuffle agencies is good only until July 1, 1948, confining it to Mr. Truman's term and halting it before it can be made a political issue in the presidential campaign of that year.

Before a Senate irrigation and reclamation subcommittee, opponents of the Missouri Valley Authority Bill introduced by Sen. James E. Murray, Montana Democrat, opened their campaign against the bill after a week of testimony by proponents.

Assistant Interior Secretary Michael Strauss urged the substitution for the Murray Bill of an authority bill drawn up by Interior, providing for not one but as many authorities as may be desired, all subordinate to the Interior. Reclamation Commissioner Bashore said the Murray Bill would mean "the beginning of the emasculation of the 43-year old reclamation service."

Montana politics entered the hearing when Rep. Wesley D'Ewart, Montana Republican and President of the Montana Reclamation Association, charged that Murray has more interest in gaining political power through MVA than in developing the basin. Hearings before the irrigation and reclamation subcommittee were to have been held last spring, but were postponed when Murray went to Montana to campaign against D'Ewart during a special election. One of the principal issues was D'Ewart's opposition to MVA.

Proponents of MVA closed their week of testimony last week with a parade of CIO, Farmers Union and other liberal witnesses. Morris Cooke, former Rural Electrification Administrator, said public utilities were leading the anti-MVA fight. Officials of the CIO MVA committee warned of utility propaganda and testified that only by one overall agency could the rivalry in the valley of the Army Engineers and the Reclamation Bureau be overcome. Don W. Chapman of the Montana Farmers Union said it would be impossible to obtain an adequate solution of the Valley's problems on an individual state basis.

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Northwest Utility Taxes Reach $27,487,990 in 1944

The stockholder-owned, business-managed electric utility companies operating in the Pacific Northwest states of Idaho, Montana, Oregon, Utah and Washington, paid $27,487,990 in taxes in 1944. Of this grand total, $16,295,138 went to the federal government, and $11,192,852 went to states and their local taxing agencies.

These facts were disclosed in a survey of electric utility company taxes for 1944 in those states, compiled by Berkeley Snow, secretary, Northwest Electric Light and Power Association.

Of the $16,000,000 federal taxes, $13,500,000 was paid in income taxes, nearly $2,000,000 in the form of electricity sales tax, while social security taxes, capital stock taxes, and various miscellaneous taxes, fees, and licenses, absorbed the balance. Of the state taxes paid, $7,283,733 were taxes on operating properties of reporting companies.

Mr. Snow points out that a comparison of the survey just released with a similar one, previously issued, covering utility taxes for the year 1941, revealed a marked increase in federal taxes. While state and local taxes fell off 1.98 percent during the past three years,

total federal taxes increased 74 percent. from a little over $9 million in 1941 to over $16 million in 1944. Among state and local taxes, state unemployment taxes were down, and municipal franchise or occupation taxes were up in the same period.

The survey entailed compiling the taxes of 22 so called private electric utility companies operating in the five-state area. Public or governmental power enterprises and electric cooperatives are not included.

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Plan Electrically Heated Homes at Coulee Dam

When new homes are constructed for government workers at Coulee Dam, Wash., they will be electrically heated, according to plans recently announced by Bureau of Reclamation officials.

This type of heating will serve a three-fold purpose, it was pointed out. While giving the Federal government a partial return for its investment in the two station-service generators installed specifically to supply the immediate area, it will give dwellers extremely low rates and conserve vital supplies of wood, oil and coal.

Output of the two 10,000 kw. generators at the west bank powerhouse is believed sufficient to supply all local demands, but additional electricity can be supplied at any time from the main bank of 108,000 kw. generators.

The new homes will replace the government-owned temporary structures built during construction of Grand Coulee Dam.

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Saskatchewan Board Plans New Generating Plant

Reflecting the expansion plans of the Saskatchewan Power Commission, Regina, is the proposal for the construction of a new steam generating plant and other extensions at Estevan for the Dominion Electric Power Co., recently acquired by the Saskatchewan Government.

Construction of new power lines in southwest Saskatchewan will allow use of Estevan-generated power in districts not now linked with the Dominion's system. Contract has already been awarded for the construction of the first section of such a link. Another contract has been let for building a power link between Assiniboia and Willow Bunch. Five power-line contracts have been awarded in the past three months, forepart of the expansion of the power commission, designed to coordinate government power lines.

FIRST HALF-CENTURY MAN — Henry A. Talbot, right, head of the office division of Boston Edison's transmission and distribution department, receives a service pin from president James V. Toner in honor of being the first employee to complete 50 years of service with that utility company

Challenges Right of P.S.C. to Allocate Service Areas

The right of the Arkansas Public Service Commission to allocate rural electrification territories to electric companies and cooperatives on an area basis was challenged at a hearing before the commission by Thomas Davis who lives in an area allocated to the Riceland Electric Cooperative but who desires service from Arkansas Power & Light Co.

Joe Morrison, former commissioner of the Arkansas commission and lawyer for Davis, said he planned to carry the case to the Arkansas Supreme Court on the grounds that the commission could not order an individual to take service from any one of two service agencies where it is available on an equal basis.

Testimony showed that the Arkansas Power & Light Co. now has a line one half a mile from the Davis home, and that the Riceland Electric Co-op line will be an equal distance away when it is built. Paul Jones, manager for the co-op, testified that Davis had not applied for membership in the co-op. Davis said that A.P.&L. had refused to serve him since he was in territory allotted the co-op.

The commission took the case under advisement.

War Time Is Over

War Time ends at 2 A.M., Sunday, September 30, in accord with the provisions of a bill signed early this week by President Truman.

N. Y. Can Exact Rent for Niagara Waters

Niagara Falls Power Loses Suit Claiming Vested Property Right Bars State from Rental Fee

Property rights which the Niagara Falls Power Co. claims to have in the waters of the Niagara River have been denied by Justice Francis Bergan of the New York Supreme Court in ruling that the State law of 1943 asserting the priority of the State to this water and directing that an equitable rental be paid for its use is valid.

The Water Power and Control Commission can now proceed to fix the rental on the 15,100 cu. ft. per second of water which the utility has long been allowed to divert from the river; however, Niagara Falls Power Co. has announced that it will appeal from the decision and carry the case to the Circuit Court of Appeals.

In denying the claims of the utility to vested property rights which the utility based on operation of law as a riparian owner and by virtue of specific legislative grants and certain state patents, Justice Bergan said,

"Niagara Falls is one of the prime natural resources of the State. It can scarcely be believed that the legislature in granting rights to use its energy, and the company's predecessors in accepting the rights given, believed that this natural resource was being placed for all time by the crystalization of contractual obligations beyond the control of the people of the state.

"The companies and the legislature in their arrangements were bound as reasonable men to anticipate, and I think they did anticipate, that the 'title' to the perpetual use of a natural resource of the very first magnitude might be disavowed by differently minded men in future times, by men who might feel that resources of this kind are inalienable and who would be unwilling that another generation bind them irrevocably in the use to be made of them."

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$425,250 Expansion Plans

Included in a $425,250 construction program announced recently by California Electric Power Co. are a line, now underway, from Garnet to Twenty-Nine Palms, Joshua Tree National Monument and the Morongo Valley, $210,000; extension from Garnet to Banning, $30,000; extension from Barstow to Harper Lake, $58,000; extension in San Bernardino County to Big Bear Lake, $50,000; and expansion in Perris Valley, $33,500.

Court Defers Proceedings on Holding Company Act

'Death Sentence' Clause Gets Another Respite When Supreme Court Loses Quorum—Justice Burton May Not Be Eligible Because of Former Connections with Parties to the Case—New Justice Called Liberal

Supreme Court determination of the constitutionality of the "death sentence" clause of the Public Utility Holding Company Act of 1935 was deferred again on the eve of a new court term at which the issue was to have been the first argued.

The court lost the quorum it had obtained to hear the case after two and one-half years when Justice Roberts resigned earlier this summer. Possibility that his replacement, Sen. Harold H. Burton, Ohio Republican, might be unable to fill out the quorum became apparent when it became known that Sen. Burton for about two years before World War I was attorney for two electric utilities which later became subsidiaries of the Electric Bond & Share System, two of whose companies are involved in the cases pending before the high court.

A quorum has been impossible to attain because so many of the present members of the court have had previous connections with one or more of the parties to the various suits. As is customary, these justices disqualified themselves.

Burton Decision Next Month

A court attache told ELECTRICAL WORLD that decision on Sen. Burton's participation will be reached after opening-term conferences during the first week of October.

Sen. Burton's appointment was unanimously confirmed by the Senate a few days after its announcement by President Truman, with whom the appointee served in the Senate on its Truman War Investigating Committee. The appointment was widely praised in the Senate and elsewhere.

The first Republican appointed to the court since President Hoover's last appointment, Sen. Burton was expected to show the liberal tendencies which put him well ahead of his party in Congress. Many felt, however, that he would stop short of the views expounded by the court's most liberal faction, headed by Justices Black and Douglas. Burton has long been a political independent, which caused the belief that he may align himself with Chief Justice Stone and Justice Reed, who often swung between the Black-Douglas coterie and the Roberts-Frankfurter group.

Burton was one of perhaps half a dozen senators who supported the House provision against construction of transmission lines and the Delta steam plant in California's Central Valley project by the Reclamation Bureau. This issue was fought at great length last spring, and settled by compromise.

Three groups of "death sentence" cases are before the Supreme Court, all seeking a ruling on the constitutionality of Sections 11(b) and 11 (b) (2) of the Holding Company Act, and all have been held up for some time for want of a quorum. Oldest case is that of the North American Co. vs. Securities and Exchange Commission, a case rising out of the affirmation in January, 1943, by the 2nd Circuit Court of SEC orders directing North American to divest itself of properties valued at $190,000,000 and to retain the Union Electric Co. as its integrated system.

FOR A SECOND UNIT—Workmen sinking a caisson at the R. E. Burger plant of the Ohio Public Service Co. where a second 60,000-kw. unit will be erected

A second group is composed of the SEC vs. Engineers Public Service Co. and Engineers vs. SEC cases which revolve around SEC orders directing Engineers to divest itself of all properties but the Virginia Electric & Power Co. and certain related businesses. Both sides are appealing from an Appeals Court decision which basically upheld SEC but which ruled that the commission erred in ordering divestment of a Virginia transportation property under the "other business" clause of Section 11(b)(1).

SEC appealed from the finding of error on its part while Engineers appealed from the ruling that the "death sentence" is constitutional and asked whether SEC should have received evidence on the point. Engineers sought also a ruling on whether all retainable properties in the integrated system must be in one geographical area.

The third group of cases involve the American Power & Light Co. and Electric Power & Light Co. in companion proceedings under 11(b)(2). Each appeals from First Circuit Court decisions of March, 1944, upholding SEC orders that they dissolve. Questions involved center on the constitutionality of 11 (b) (2).

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Arkansas Utility to Serve Dyess Rehabilitation Area

Arkansas Public Service Commission has authorized Arkansas Power & Light Co. to purchase a 3-mile transmission line from its system into the Dyess rural rehabilitation center for $13,500, and has allocated to the company the territory in the rehabilitation colony. A.P. &L. will build 40 miles of rural line in the colony at a cost of $32,000 to serve 303 customers.

The Dyess colony was established early in the New Deal as a rural rehabilitation experiment. Although all the houses in the colony were wired when built, service never was extended to them. Mississippi County Electric Cooperative Corp. sought to serve the colony, but at a hearing before the commission, directors of the colony cooperative expressed preference for A.P.&L. service because they said it would be better and rates would be cheaper than the co-op's. A.P.&L. will establish a service organization at the colony.

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Service Extended to Town

Missouri Utilities Co. has received permission from the Missouri Public Service Commission to extend electric service to Egypt Mills, previously unserved.

Northwest Groups Plan New Business

Electric Light & Power Committees Meet at Seattle to Determine Activities for Coming Year

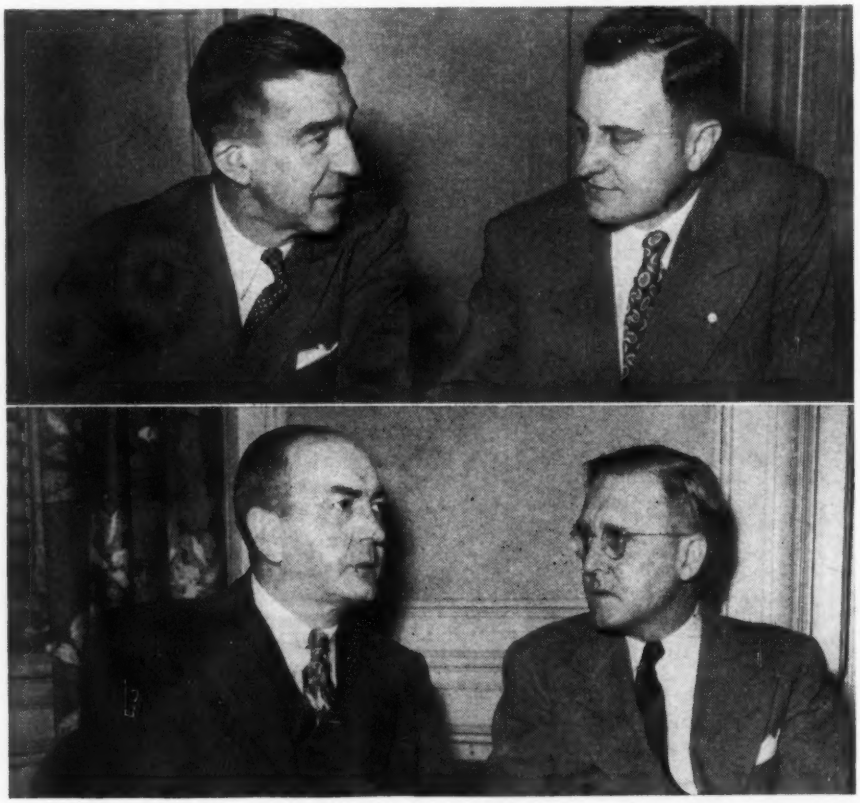
Planning for new business for all five branches of the electrical industry in peacetime brought new tone and tempo to the first meeting held by the Northwest Electric Light and Power Association since V-J Day. In Seattle on September 12, the association's executive committee met to discuss programs for each of the four sections and to approve a budget for the current year. On the same day, the electrical development committee, the association's over-all planning committee, met to plan a coordinated operation.

Present at both meetings were representatives of utilities, manufacturers, wholesalers, appliance dealers, and electrical contractors. Emphasis was on a coordinated activity with the association acting as a common meeting ground for all these branches.

Each of the four sections, accounting, business development, engineering, and personnel are planning two conferences during the year, a smaller fall conference of executives to detail a program and a larger conference in the spring to bring this program to completion. Many of the section subcommittees, of necessity dormant during the war period, will be reactivated and will focus attention on economic operation or building business.

Principal emphasis of both meetings was on the business development section which has before it the important subjects of water heater standardization, electric house heating, and industrial development. New activities looking toward increased business in the farm, residential, commercial, and industrial fields will be set up. Most of the utilities in the area will not merchandise appliances though a few will merchandise in those spots not adequately covered by established dealers.

Utility accountants are initiating studies looking toward economy of procedure. The engineers, not now pressed for additional capacity, will continue their studies of improved operating with particular attention to rural service, and in addition will undertake studies of load factor, demands, and diversity of house heating, a subject particularly live at this time in the Pacific Northwest. The personnel group sees necessity for rounding out a program in employees' relations field, and for employment of returning veterans.



PLANNING FOR THE FUTURE—Top, George Bragg, Pacific Power & Light Co., left, and Lou Thrailkill, Washington Water Power Co., vice-presidents for Oregon and Washington of the Northwest Electric Light and Power Association, confer before the recent meeting of the association's executive committee. Bottom, Pat Johnson, Puget Sound Power & Light Co., left, president of the association, and Tom Roach, Northwestern Electric Co., association vice-president

Union, Utility Agree on Evaluation of Jobs

A job evaluation plan which the Jersey Central Power & Light Co. negotiated over an eight-month period with six local unions of the International Brotherhood of Electrical Workers has been filed with the Regional War Labor Board in New York, E. H. Werner, president of the utility, has announced.

It is believed that this negotiated evaluation is unique in the industry in that it represents the first time in which an international union has joined with management in an effort to eliminate inequities in the wage structure.

A committee of eight, equally divided between the locals and the management, started its work by writing complete job descriptions for each of the approximately 125 job classifications in the company, covering more than 800 unionized employees. The jobs were then evaluated according to a point-factor system developed by R. C. Simpson, Gilbert Associates, Inc., labor relations counsellor for the company. This system was developed for particular use in the utility industry and places special emphasis on factors which are peculiar to utility work, such as public contacts, personnel hazards, and varying work schedules.

Though no immediate reduction of pay is called for by the proposed evaluation, since the personal rates which exist above the evaluated rate are frozen, it is the belief of the management that the result of the plan will be to stabilize the company's wage structure and eliminate controversies over wage inequities. It is the latter result that is also valuable to the union leaders who are always under pressure to correct so-called wage inequities.

The plan provides for a periodic review to keep it in step with job changes.

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Utility Valuations Rise

Changes in the valuations and tax assessments of two electric utility companies have been announced by the Wisconsin Department of Taxation. New property valuations arrived at by the state assessors show an increase from $14,500,000 to $14,700,000 for the Wisconsin Michigan Power Co., which this year will pay property taxes totaling $328,346, against $323,561 last year. Valuation of the Wisconsin Public Service Corp. has risen from $42,800,000 to $43,200,000, with the company assessed $964,938 in property taxes this year as compared with the $955,064 levy of last year.

OWU Closes Doors, Ends Work by Writing History

Agency and Predecessors Served Four and One-Quarter Years and Had Almost Complete Control of Construction and Operation of Electric Utilities—Retiring Personnel Announce Future Plans

The Office of War Utilities officially closed its doors this week after four and one-quarter years in which it and its predecessors had almost complete control over the broader phases of construction and operation of electric utilities. Through the years it acquired similar controls over gas, water, steam heat and communications utilities, but from start to finish, electric power was its biggest job.

Most of OWU's final days were spent in the throes of literary composition as a fragment of the earlier staff—perhaps 60 people of a peak of about 500—compiled the agency's history under a WPB policy directing that each WPB agency leave behind a documented record.

Staff Relaxes at Party

The drudgery of history-writing was alleviated briefly a week before the end when a "close-out" party was staged at Washington's Mayflower Hotel under the direction of Paul Valle, U-1 administrator. Nearly 300 persons, including many former OWU staff members, attended the wake and saw Director Edward Falck receive a handsome leather briefcase. The affair took its own place in history as the first OWU party which broke even when it came time to pay the bills.

Deputy Director Charles F. Weiler, it was learned, will return next week to the Wisconsin Telephone Co., at Milwaukee, whence he joined WPB in June, 1942, to make special studies of the Materials Control Plans then being debated. He became chief of the Materials Control Branch when OWU was organized in February, 1943, and Deputy OWU Director somewhat more than a year later when Falck became director.

Valle, deputy director of the Power Division since January 1 and administrator of Order U-1 since it was written, would make no announcement of his future plans until the OWU job ended. He went to WPB in January, 1942, from the Rural Electrification Administration.

O. L. Hooper, chief of the Fuel and Allocations and Conservation Branches, probably will retnrn to the consulting field. Hooper went to WPB in April, 1942, from the Federal Power Commission which he joined after ten years with the J. G. White and E. M. Gilbert Engineering Corps. With WPB he served successively in the Power Division's Statistical and Power Supply Sections, later becoming chief of the Power Allocation Branch and finally chief of the branches he now heads.

C. W. Jones, chief of the Equipment Production Branch since last spring and before that a veteran with the organization, returns to the New England Power Association from which he has been on loan intermittently for years.

William J. Bailey, who joined the Equipment Production Branch's hydro section in October, 1942, last spring became secretary of the power sub-committee of the technical industrial intelligence committee, under whose auspices experts toured liberated Europe and Germany to study Nazi power developments and methods. He has been on loan to WPB from TVA's hydroelectric construction corps for three years.

Two Will Go to Japan

Two of the remaining members of the Power Supply Section, George Grimm and Stephen P. Darlington, were to leave next week for Japan as members of a crew to make a strategic bombing survey for the Army. The assignment was to run until the year's end.

Grimm, who joined WPB in June, 1942, from the Indiana Service Corp. at Fort Wayne, has been in the Power Supply Section since, handling both Southeastern and North Central States. On his return in January he will become operating vice-president of the Florida Power Corp. at St. Petersburg.

Darlington went to WPB in January, 1943, from the South Carolina Public Service Authority, and has been in the Power Supply Section since. He handled the Northwest, and more recently, the North Central States as well.

Harry L. Parlette, who resigned recently after almost three years in the Power Supply Section, will go to the Long Island Lighting Co. as assistant to the vice-president. He went to WPB in the fall of 1942 from the West Penn Power Co., and handled the Middle Atlantic States power supply.

Donald C. Ketcham, who went to WPB from REA early in 1942, will return to REA. He had handled power supply problems for New England and upper New York State.

Harry F. Lowe, chief of the Materials Control branch since Weiler became deputy director, will return to the consulting firm of Sloan & Cook, Chicago; he joined the communications group in March, 1942.

Norvelle Jacobsen, who as secretary to several power division directors and deputy directors from almost the earliest days of the organization probably dealt with more utility officials than any other member of OWU, resigned recently to join the Pacific Gas & Electric Co. at San Francisco. She went to WPB from the Potomac Electric Power Co. in Washington.

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Directors of Omaha P.P.D. Named by Gov. Griswold

Governor Dwight Griswold of Nebraska has appointed the seven-man board of the Omaha Public Power District recently organized to take over the Nebraska Power Co.

Directors from Omaha are Samuel L. Cooper, president and treasurer of Orchard & Wilhelm Co.; David Goldman, general manager and secretary-treasurer of Herzbergs, Inc.; J. M. Harding, investments; Charles D. Saunders, vice-president of the First National Bank; and Carl A. Swanson, president of Carl A. Swanson & Sons.

From the district outside Omaha, directors are Roy E. Bott, Hooper, partner in J. R. Bott & Son, implement firm; Karl C. Brown, Papillion, vice-president of the banking house of A. W. Clarke.

All of the men but Mr. Swanson were members of the second Peoples Power Commission appointed last March by the governor and Dan Butler, then mayor of Omaha. The commissioners resigned when the law under which the commission had been established was repealed.

Future directors will be elected by voters of the district. Terms of Directors Swanson and Goldman expire in November, 1946; of Bott, Saunders, and Cooper in 1948; and of Brown and Harding in 1950.

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Taxes Utilities Bills

Bradenton, Fla., has passed an ordinance levying a tax on all utilities bills, effective October 10. The rate will be 10 percent on bills for the first $25, 5 percent for the next $50, and 1 percent thereafter.

Los Angeles Plans $18,183,000 Program

Reports and estimates for Los Angeles municipal power system projects totaling $18,183,000 to be initiated before next June 30 were filed September 13 with the Board of Water and Power Commissioners by General Manager Samuel B. Morris.

The projects are the first step in an 8 to 10-year program of extensions and improvements, approved by the board last December.

Some $10,700,000 actually will be expended by next June 30. In addition the power system will initiate $7,483,000 in work by that date.

Chief Electrical Engineer C. P. Garman reported that power system projects include a second 65,000-kw. unit at the new Los Angeles Harbor steam plant, to cost $6,325,000; construction of a transmission line between Receiving Stations B and D, $2,313,000; expansion of Receiving Station F, $2,111,660, and construction of new substations in the West Los Angeles and San Fernando Valley areas, $1,559,000.

Nearly all contracts for equipment on the steam plant have been awarded or specifications are out for bids, it was reported. Construction work is expected to begin by November 1.

Large quantities of poles and line materials have been purchased to provide for maintenance and improvements delayed because of the war. This work has begun, as well as similar work on the underground system, and will expand as more materials and men become available.

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A. S. MacMillan Resigns Nova Scotia Chairmanship

A. S. MacMillan, 74-year-old premier of Nova Scotia and chairman of the Nova Scotia Power Commission, has resigned from both positions, and A. L. MacDonald, new premier, has not yet appointed a power commission chairman.

Mr. MacMillan was one of the few men heading government power commissions in North America holding a card in the International Brotherhood of Electrical Workers. In his youth, he left his Nova Scotia home to go to Massachusetts where he took up line work for power and telephone companies. Later he went to New York where he continued electrical work and attended a Brooklyn technical school at night.

After graduating, he conducted an electrical business in turn at New York, Philadelphia, and Boston. Upon his return home, he organized and headed the Antigonish & Guysboro Rural Electric Co. Later he entered politics and for many years was provincial minister of highways.

MEETINGS

Edison Electric Institute—Prime movers committee (change in date), Statler Hotel, Buffalo, N. Y., October 1-2. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York 17, N. Y.

Pennsylvania Electric Association—Meter Committee, Roosevelt Hotel, Pittsburgh, Pa., October 25-26. B. M. Smith, chairman, Pennsylvania Electric Co., Erie, Pa.

Rocky Mountain Electrical League—Annual meeting, Shirley Savoy Hotel, Denver, Colo., October 25-27. R. B. Hubbard, manager, Gas & Electric Bldg., Denver 2, Colo.

National Electrical Contractors Association—Annual meeting, Carter Hotel, Cleveland, Ohio, October 29-31. C. J. Harder, national secretary, 633 Investment Bldg., 15th and K Sts., N. W., Washington, D. C.

Southeastern Electric Exchange—Commercial Section (change in date and place), Atlanta Biltmore Hotel, Atlanta, Ga., December 5-7. J. W. Talley, executive secretary, 303 Haas-Howell Bldg., Atlanta 1, Ga.

Previously Listed

Southeastern Electric Exchange—Engineering and Operation Section, Sir Walter Hotel, Raleigh, N. C., October 4-5. John W. Talley, executive secretary, 303 Haas Howell Bldg., Atlanta 1, Ga.

Electrochemical Society—Electro-Organic Division, Chicago, Ill., October 5; Electrothermic Division, Columbus Ohio, October 12; Electronics Division, Philadelphia, Pa., October 17; Electro-deposition Division, New York, N. Y. October 24. Colin G. Fink, secretary, Columbia University, 3000 Broadway, New York 27, N. Y.

Kansas Association of Municipal Utilities—Annual convention, Broadview Hotel, Emporia, Kansas, October 7-9. Edgar P. Schowalter, secretary-treasurer, c/o Board of Public Utilities, Kansas City, Kansas.

Edison Electric Institute—Transmission and distribution committee, Cleveland Hotel, Cleveland, Ohio, October 15-16; electrical equipment committee, Cleveland Hotel, Cleveland, Ohio, October 17-18; accident prevention committee, Lord Baltimore Hotel, Baltimore, Md., October 25-26. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York 17, N. Y.

International Association of Electrical Inspectors—Western Section, LaSalle Hotel, Chicago, Ill., October 15-16; F. H. Moore, secretary, 320 N. Meridian St., Indianapolis, Ind. Eastern Section, Hotel New Yorker, New York, N. Y., October 22-23; F. N. M. Squires, secretary, 85 John St., New York, N. Y. Southern Section, Baker Hotel, Dallas, Texas. October 29-31; A. M. Miller, secretary, 219 Governor St., Richmond 19, Va.

American Welding Society—Annual meeting, Pennsylvania Hotel, New York, N. Y., October 18, M. M. Kelly, secretary, 33 W. 39 St., New York 18, N. Y.

Missouri Valley Electric Association—Fall sales conference Hotel Continental, Kansas City, Mo., October 18-19; fall accounting conference, Hotel Continental, Kansas City, Mo., October 24-25. I. D. Pettegrew, director, 1004 Baltimore St., Kansas City 6, Mo.

Pennsylvania Electric Association—Electrical equipment, committee (tentative), Benjamin Franklin Hotel, Philadelphia, Pa., October 25-26; B. E. Hagy, chairman, Philadelphia Electric Co., Philadelphia, Pa. Systems operation committee, Penn Harris Hotel, Harrisburg, Pa., November 8-9; A. R. Deck, chairman. Metropolitan Edison Co., 412 Washington St., Reading, Pa.

American Society of Mechanical Engineers—Annual meeting, Hotel Pennsylvania, New York, N. Y., week of November 25. Ernest Hartford, executive assistant secretary, 29 W. 39th St., New York 18, N. Y.

Amended Merger Plan Given P.S.C. Approval

4 Niagara Hudson Properties Will Be Consolidated in New Buffalo Niagara Electric Corp.

An amended plan for the consolidation of three operating companies and one holding company, comprising the western division of Niagara Hudson Power System, into a single operating company has been approved by the New York Public Service Commission.

The authorization is contingent upon ratification of the plan by the stockholders of the four companies, Buffalo Niagara Electric Corp., Niagara, Lockport & Ontario Power Co., Lockport & Newfane Power & Water Supply Co., and Buffalo, Niagara & Eastern Power Corp., an intermediate holding company, which controls the three operating companies through ownership of their capital stock.

Most important of the subsidiary companies which will remain after consolidation is Niagara Falls Power Co. which will become a direct subsidiary of the new operating corporation, Buffalo Niagara Electric Corp.

Original Plan Failed

The amended plan was substituted for the original plan (ELECTRICAL WORLD, June 16, Page 8) when insufficient local capital was forthcoming to retire the Buffalo, Niagara & Eastern $1.60 preferred stock and provide local control which would have eliminated Niagara Hudson Power Corp. from the western division.

Niagara Hudson Power Corp., the parent holding company, under the amended plan will provide $63,000,000 in cash to retire the 284,180 shares of Buffalo, Niagara & Eastern $1.60 preferred stock held publicly and to pay accumulated back dividends on these securities. Niagara Hudson will also contribute its holdings of 12,545 shares of the same securities by cancelling them.

In addition, dividends on 350,000 shares of $5 preferred stock of Buffalo, Niagara & Eastern, unpaid for three years, will also be paid.

The new corporation will repay Niagara Hudson by issuing to it 3,000,000 shares of common stock. This will give Niagara Hudson control of western division properties with total assets of close to $275,000,000. In other respects the amended plan is similar to the original.

Dissolution of the Niagara Hudson System by the Securities and Exchange Commission is expected within a short time.

3 Utilities Sign Contract for Water District Power

A contract with the Metropolitan Water District securing all its unused Boulder Dam firm power for the next 42 years was approved by the Los Angeles Board of Water and Power recently. The Los Angeles municipal utility, along with the Southern California Edison Co. and the California Electric Power Corp., will receive under the contract about 1,358,000,000 kw.-hr. of hydroelectric power annually, split on a 55-40-5 basis respectively.

This power was previously contracted for by the Los Angeles Metropolitan Water District who used it for pumping and incidental purposes, but currently has been using but 10 percent of the original contract's yearly 1,500,000,000 kw.-hr. The new contract will increase total revenues of the Water District by some $25,000,000 during the period involved.

The deal insures uninterrupted delivery to the three contractors of large supplies of low cost energy, with the amount decreasing as the Water District utilizes additional electrically operated equipment in their system.

The present cost of Boulder firm power is set at 1.244 mills per kilowatt-hour, but delivery to the utilities will be at a much lower rate during a development period for creation of outlets for resale. For the first five years of the contract, cost to them will be successively 40-50-65-80-95 percent of the established rate.

The Secretary of the Interior and the Reconstruction Finance Corporation are also signatories to the agreement.

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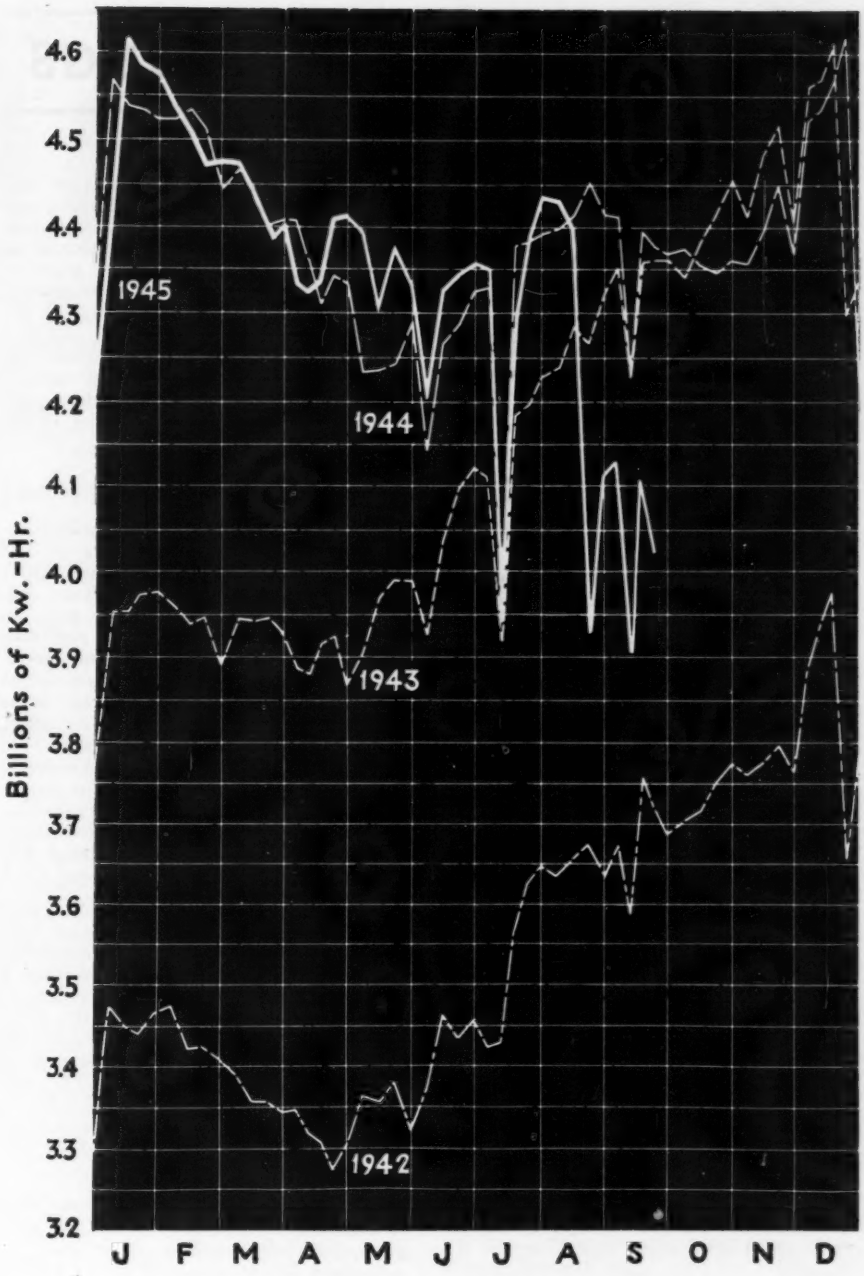
Work on 3 Grand Coulee Dam Units Now Underway

Under revitalized contracts with the Bureau of Reclamation, Westinghouse Electric Corp., Woodward Governor Co. and the Newport News (Va.) Shipbuilding & Dry Dock Co. have begun the post-war job of constructing parts for three 108,000-kw. generators for Grand Coulee Dam, Bureau officials announced in mid-September.

At an installed price of about $2,000,000 each, the units are intended to serve the world's biggest pumps in providing water for the Columbia Basin irrigation project.

The three new generators will complete the powerhouse on the west bank of the Columbia River below Grand Coulee and bring its hydroelectric output to the planned 992,000 kw. Installation is expected to be completed in 1948.



Electric Output Curve in Sharp Drop

The electric output curve dropped sharply during the week ended September 22, 1945, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power industry totaled 4,018,913,000 kw.-hr., compared with 4,106,187,000 kw.-hr. during the preceding week. During the week ended September 23, 1944, the amount of electrical energy distributed amounted to 4,377,339,000 kw.-hr., this year's figure representing a decrease of 8.2 percent.

Only one of the seven major geographical regions of the country reported a gain as compared with the corresponding week of 1944—the Rocky Mountain States with an increase of 3.1 percent.

Weekly Output Millions Kw.-Hr.

1945		1944		1943	
Sept. 22	4,019	Sept. 23	4,377	Sept. 25	4,360
Sept. 15	4,106	Sept. 16	4,395	Sept. 18	4,359
Sept. 8	3,909	Sept. 9	4,228	Sept. 11	4,229
Sept. 1	4,137	Sept. 2	4,415	Sept. 4	4,351
Aug. 25	4,116	Aug. 26	4,418	Aug. 28	4,322
Aug. 18	3,939	Aug. 19	4,451	Aug. 21	4,265
Aug. 11	4,395	Aug. 12	4,415	Aug. 14	4,288
Aug. 4	4,432	Aug. 5	4,399	Aug. 7	4,241
July 28	4,435	July 29	4,391	July 31	4,227
July 21	4,385	July 22	4,381	July 24	4,196
July 14	4,295	July 15	4,377	July 17	4,184
July 7	3,978	July 8	3,941	July 10	3,919

Percent Change from Previous Year

	Week Ending		
	Sept. 22	Sept. 15	Sept. 8
New England	— 4.4	+ 0.3	— 11.0
Mid Atlantic	— 4.2	— 3.7	— 7.2
Central Industrial	— 12.2	— 11.9	— 13.6
West Central	— 2.0	+ 0.6	+ 2.2
Southern States	— 10.6	— 4.1	— 4.0
Rocky Mountain	+ 3.1	— 1.3	— 2.8
Pacific Coast	— 5.9	— 7.9	— 3.6
Total United States	— 8.2	— 6.6	— 7.5

SEC DECISIONS—HEARINGS

The Securities and Exchange Commission recently issued a series of orders affecting electric utility companies.

FEDERAL LIGHT & TRACTION CO.'s proposal to sell all 6,500 outstanding shares of $100 par value common stock of Sheridan County Electric Co. of Sheridan, Wyo., to Gerald L. Schlessman of Denver, Colo., for $641,015, subject to closing adjustments, was sanctioned by the SEC. Federal plans ultimately to use the proceeds from the sale, through which it will comply with an SEC divestment order of August 17, 1943, for the retirement of outstanding securities.

COLUMBIA CORP.'s dissolution and distribution of its net assets as a liquidating dividend to its parent, the Columbia Gas & Electric Corp., has been approved by the Securities and Exchange Commission as being necessary to "effectuate compliance with the provisions of section 11 (b) of the Holding Company Act and a commission order of November 30, 1944." Columbia Gas, which carries the value of its investment in Columbia Corp. at $5,750,000, will record the net assets acquired from its wholly owned subsidiary at $3,804,371. It will make disposition of the $1,945,628 difference by charging special capital surplus and by crediting earned surplus since December 31, 1937, with $2,468,816 and $523,188, respectively. Columbia Gas will then retire the preferred, preference and common stocks received in the liquidation of Columbia Corp.

COMMONWEALTH & SOUTHERN CORP.'s proposal to pay a dividend of $1.25 on the company's preferred stock has been approved. The dividend will be payable October 15 to holders of record October 1. Commonwealth & Southern has 1,482,000 shares of preferred stock outstanding.

NEW ENGLAND PUBLIC SERVICE CO.'s request for the postponement of the reconvening of a hearing in connection with the company's amended plan of reorganization and related matters has been granted.

ASSOCIATED ELECTRIC CO. has been given an extension of time until November 30 for the sale of its entire interest in the Missouri General Utilities Co., its subsidiary, and its acquisition of certain assets of Missouri General.

PEOPLE'S LIGHT & POWER CO.'s amended recapitalization plan has been approved by the commission in a supplemental finding. SEC announced that it would immediately apply to a United States District Court for an enforcement order to carry out the provisions of the plan as amended. Under the proposal, Texas Public Service Co. will be merged into Peoples. In order to secure commission approval, Peoples had to eliminate the proposed payment of a dividend of $1 a share on the new stock provided for in the plan, and increased the cash distribution to be made to preferred stockholders from $13 to $16 a share. The commission retained its jurisdiction with respect to the original cost studies relating to the utility properties to be acquired by Peoples; to revise or pass upon any revision of the procedure set forth in the plan for the nomination and election of a new board of directors, and to pass upon the allocation and reasonableness of all fees and expenses incurred in the proceedings. The new order, however, is not to be considered as authority for the issuance of securities, transfer or acquisition of securities or assets, distribution of cash, or assumption of bonds contemplated in the amended plan until a United States District Court order issues enforcing its provisions, according to the commission's statement.

Applications Filed

UNION ELECTRIC CO. OF MISSOURI has registered $13,000,000 first mortgage and collateral trust bonds due 1975 and 40,000 shares of preferred stock. The issues will be sold at competitive bidding and the offering price and interest rate and dividend rate will be filed by amendment. Proceeds will be applied to the redemption of $9,000,000 face amount promissory notes maturing Dec. 28, 1945, and to financing, on a permanent basis, the purchase in March, 1945, of the properties and business of Laclede Power & Light Co. for an adjusted price of $8,439,908. This transaction was temporarily financed out of company's cash resources. Proceeds remaining will be applied to the company's general fund.

FEDERAL LIGHT & TRACTION CO. has filed an amendment to its reorganization plan providing for Federal's sale, conditioned upon certain transactions, to J. C. White & Co., Inc., New York, of 20,000 shares of $100 par value common stock of the Trinidad Electric Transmission, Railway & Gas Co. for $790,000. The shares represent all Trinidad's outstanding capital stock. Federal, a subsidiary of Cities Service Power & Light Co., said it ultimately would use proceeds from the sale to retire its outstanding securities.

GULF STATES UTILITIES CO., a subsidiary of Engineers Public Service Co., has filed an application proposing to decrease its authorized 420,000 shares of stock by eliminating 20,000 shares of unissued, no par value common stock. The 400,000 remaining authorized shares of stock are classified as 120,000 shares of preferred, $100 par value, and 280,000 shares of no par common. Gulf States, which would amend its charter to provide for the decrease in authorized stock, said the proposed step would be a part of a plan filed by Engineers on September 10, pursuant to Section 11(e) of the Public Utility Holding Company Act of 1935. In its application Gulf States also proposed to change its outstanding 280,00 common shares into 1,909,968 shares of no par value common, issuing the new shares to stockholders on a pro rata basis. Gulf States would then grant to holders of the outstanding 120,000 shares of preferred stock seven votes per share instead of one. At the same time, El Paso Electric Co., another subsidiary of Engineers, filed an application proposing to amend its charter so as to change its presently authorized issued and outstanding 150,000 shares of common stock, no par value, into 381,994 shares of common stock, no par value.

NIAGARA HUDSON POWER CORP. has filed a plan for the merger of Union Bag & Paper Corp. into New York Power & Light Corp. Niagara Hudson proposes to sell to New York Power all the outstanding 5,000 shares of Union's no par value capital stock with an aggregate value of $4,256,740. New York Power would issue to Niagara Hudson 150,000 additional shares of its common with the same aggregate value. The merger would result in elimination of a corporate entity of the Niagara Hudson System, simplifying the corporate structure, the application said. New York Power would receive the electric generating facilities of Union from which it now purchases excess power.

ASSOCIATED GAS & ELECTRIC CO., Associated Gas & Electric Corp., Associated Electric Co. and NY PA NJ Utilities Co. filed a joint application, seeking approval of a proposed settlement of intercompany claims.

AMERICAN POWER & LIGHT CO., intermediate holding company in the Electric Bond & Share Co.'s holding-company system, has filed a proposal for the further simplification of its corporate structure. American seeks commission approval for the sale of its holdings of $10,589,000 principal amount of 5 percent thirty-year debentures of its subsidiary, Montana Power Co. Proceeds would be used to retire a portion of its outstanding gold debenture bonds, 6 percent series, due 2016, or, at American's election, to acquire or retire a portion of the outstanding 6 percent gold debenture bonds, Series A, due 2022, of Southwestern Power & Light Co., which were assumed by American.

Hearings Scheduled

OCTOBER 1: On application of Public Service Co. of Oklahoma for authority to issue and sell at competitive bidding $22,500,000 principal amount of first mortgage bonds, Series A, to mature July 1, 1975, and 98,500 shares of cumulative preferred stock, par value $100 a share.

OCTOBER 2: On proposed issue and sale by Northern States Power Co. (Minn.) of $75,000,000 first mortgage bonds, due 1975.

OCTOBER 4: On joint proposal filed by Pennsylvania Power Co., and its parent, Ohio Edison Co. Pennsylvania proposes to issue at private sale to banks $800,000 of installment promissory notes, and to issue not more than 42,000 shares of a new preferred stock, $100 par value, to be exchanged for an equal number of outstanding shares of preferred.

UTILITY REPORTS

	Net Income 1944	1945
*American Gas & Electric and subs	$12,453,718	$11,862,823
*California Electric Power and subs	1,339,397	1,295,200
†Central Maine Power	3,120,149	3,215,262
†Connecticut Light & Power	3,933,454	3,692,020
†Detroit Edison and subs	6,143,977	8,347,577
*Electric Power & Light and subs	12,287,740	5,543,180
†Public Service New Hampshire	1,426,096	1,332,526
*San Diego Gas & Electric	1,567,447	1,526,246
†Texas Power & Light	2,743,247	2,594,759

*Twelve months ended July 31.
†Twelve months ended August 31.

HOW

DESIGN · CONSTRUCT · OPERATE · MAINTAIN

Wire-Strain Gage Measures Earth Pressure

EUGENE H. WOODMAN
Chief, Electrical & Mechanical Section
U. S. Waterways Experimental Station, Vicksburg, Miss.

Earth-settlement pressure in earth-filled dams and micro and macro-turbulence on the bed of the Mississippi River is being successfully measured by means of special earth pressure cells, employing modified resistance, wire-strain gages in combination with electronic amplifiers at the U. S. Waterways Experimental Station near Vicksburg, Miss.

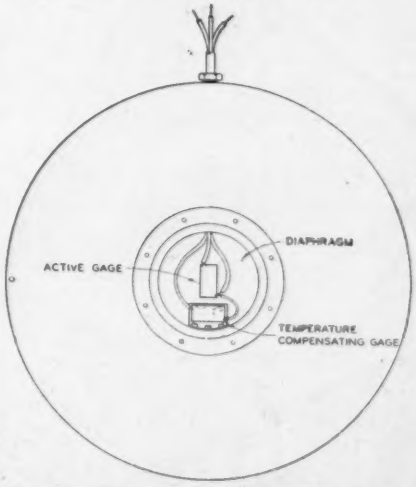
Basic element of the earth pressure cells being used in these studies, is a type SR-4 resistance, wire-strain gage consisting of a grid or very fine resistance wire assembled on a thin layer of paper with suitable protective felt covering. This gage is cemented to a metal diaphragm which deflects under pressure producing a strain on the wire grid and changing its resistance. Effect of this change in resistance on a special Wheatstone bridge, when amplified and correlated with pressure applied, provides a measure of the pressures under observation.

Temperature compensation in the cells is secured by mounting a second strain gage on the portion of the cell not subject to strain. This compensating gage is connected to one arm of an input bridge, in opposition to the tension gage, resulting in a cancellation of strain changes in the material due to temperature variations. A three-conductor cable circuit runs from the cell; one lead is common to both gages. The complete circuit comprises one-half of the Wheatstone bridge used with the gage.

In the earth pressure cell the load does not act directly on the diaphragm but is applied to a machined face-plate connected to the cell body through a flexural ring milled in its periphery. Space between the face plate and diaphragm is filled with transformer oil under low pressure. This construction insures that any uneven pressure applied to the face plate will be uniformly applied to the diaphragm.

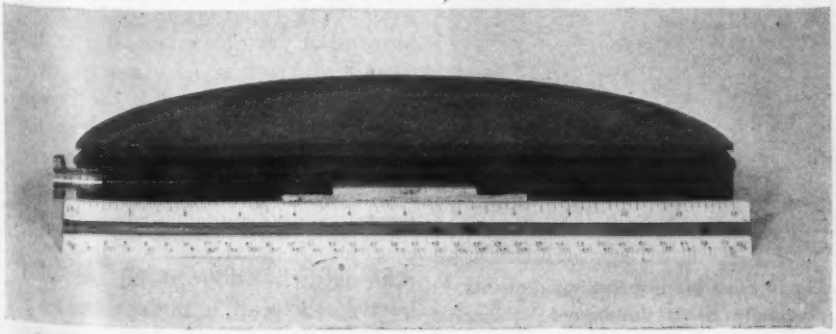
A six-channel electronic amplifier is used in conjunction with these resistance strain gages. While both a. c. and d. c. type amplifiers have been used, a more or less standard circuit has been developed which includes a 2,000-cycle oscillator to supply bridge voltage, a three-stage amplifier, rectifier and filters.

These earth pressure cells have a linear characteristic over their entire operating range. The calibration curve is secured by making incremental applications of pressure to the gage and computing resistance changes from readings required to balance the special Wheatstone bridge. In operation the amplifier is brought to a resistive and capacitive balance after which 0.1 ohm resistance steps are made as calibration of the oscillograph record. This calibration is then used in conjunction with the gage factor as a means of interpreting the pressure records obtained during the operation.



CONSTRUCTION drawing of earth pressure cell with components

The Waterways Experiment Station, where these gages are in use operate under the supervision of Brigadier General Max C. Tyler, president, Mississippi River Commission, which is a direct agency of the Office of the Chief Engineers, War Department. Director of the Experiment Station is Gerard H. Matthes, head engineer.



CROSS SECTION OF 12-IN. earth pressure cell which includes wire-string gage

Improved Lighting in Switchboard Room

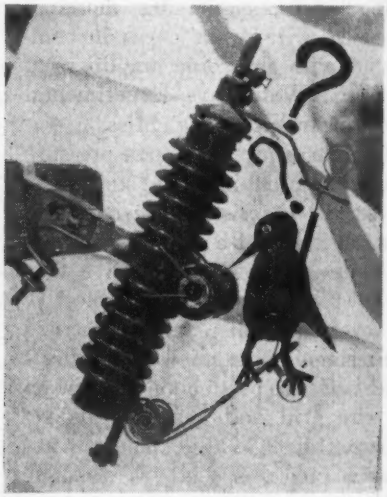
At the Webster Street steam plant of the Worcester County Electric Co., Worcester, Mass., the lighting of the meter boards in the operating room was formerly by reflector type units and desk lamps yielding low intensities and rather spotty distribution, accompanied by considerable eyestrain and fatigue. A survey by the company's lighting engineer, W. S. Mowry, led to the replacement of the older equipment by a fluorescent job in which eleven Sylvania units totaling but 880 watts were installed in a 46-ft. horizontal assembly about 15 ft. above the floor, extending 3 ft. beyond the ends of the longer board along the median axis between the two boards shown. The operating room is 19 ft. wide, and about 2,000 meter readings are made and recorded daily. Each lighting unit consists of two parallel 4-ft., 40-watt tubes mounted in glare-shielding louvers.

Each switchboard is 90 in. high and the panels of the two boards are separated by about 8 ft. 3 in. The ceiling is finished in white, and rises at one side to a level 21.5 ft. above the floor, the lower end being 11.5 ft. above the floor. The irregular shape of the room presented something of a problem, but the readings after 1,200 hr. of operation were 38 foot-candles on the top row of meters, 34 half way down and 24 on the bottom row. At the rear of the room behind the longer board five 150-watt Holophane reflecting units have been installed to serve that section of the premises, these being spaced 12 ft. apart and mounted 12 ft. above the floor. One of these units is supplied from the station exciter battery to insure continuous service in case of a general interruption of energy supply at the buses, the others being on a separate circuit, as are also the fluorescent units.

ABOUT 2,000 METER READINGS every 24 hours have been greatly facilitated in this generating plant of approximately 53,000-kw. capacity by a fluorescent lighting installation totaling but 880 watts. High degree of visibility on all faces of indicating and recording instruments mounted on the two facing switchboards

Porcelain Spool Reduces Blowing of Fuse

Attachment of porcelain spools to 13-kv. transformer fuses has eliminated the blowing of the fuses, frustrated the birds which were the cause and at the same time saving their lives. Addition of the spool at the center of the porcelain holder, as shown in the illustration, was the idea of Earl Schultz, line foreman, of the Florida Power & Light Co.

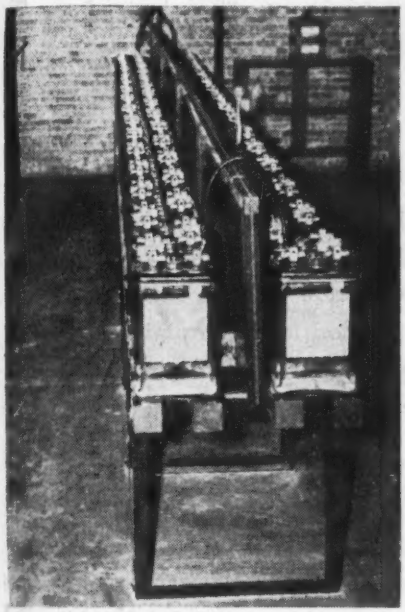


PORCELAIN SPOOL tied over metal-grounded band at center of fuse prevents bird pecking, causing fuse to blow

The foreman and his line gang were being run ragged by the fuses blowing at various times all over the 64-mile district, and for no apparent reason. On his arrival at the Prison Farm at Belle Glade to re-fuse the transformer for the fifth time in one day, he learned the cause. A prison trusty told him that birds were sitting on the arm of the fuses, and pecking at the shiny metal grounded band in the middle, thereby suddenly meeting their fate and blowing the fuse.

Reading Hydrometer Is Convenient Here

Where space is not at a premium this arrangement of station battery cells, all on one level and with the top



BATTERY CELLS all on one level at convenient height take stoop and stretch out of hydrometer readings

of the cells at a conventient 47 in. from the floor will win applause from the men who take the hydrometer readings.

Space restrictions and tradition seem to have made the three-tier arrangement of battery cells almost standard. But in such installations only one of the three tiers will be at a convenient level; the other two will be either too low or too high for comfort; sometimes both. Usually the operator has to stand on tiptoe and lean over the bottom two tiers to read the hydrometer on the top tier.

With plenty of space available at its East Chicago substation, Northern Indiana Public Service Co., built this battery rack to bring the top of the cells at a convenient height with all cells on one level. The barrier between rows is to prevent anyone laying tools across the top of the rows accidentally.

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Anti-Rust Compositions Include Lubrication

Rust preventing and rust inhibiting compositions which also possess lubricating qualities, are described by R. H. Bruni and J. W. Jones, in U. S. Patent 2,366,486, according to *Glycerine Facts*. These glycerine-containing compositions, which may be painted, sprayed or otherwise applied, will protect iron or steel pipes and fixtures that are subject to moisture or dampness from rusting for an indefinite period of time. These compounds are also useful in preventing bolts and nuts from corroding, thus facilitating their removal when desired. Such combinations are also said to be useful in painting equipment in salt-water vessels to keep them from rusting.

Thus a product specifically designed for preventing rubber tires from sticking to metal rims, but typical of the other anti-rusting compounds described, consists of:

Graphite	2½ ounces
Glycerine	2 ounces
Alcohol	1 ounce
Manganese resinate	7 grams
Liquid japan	220 grams

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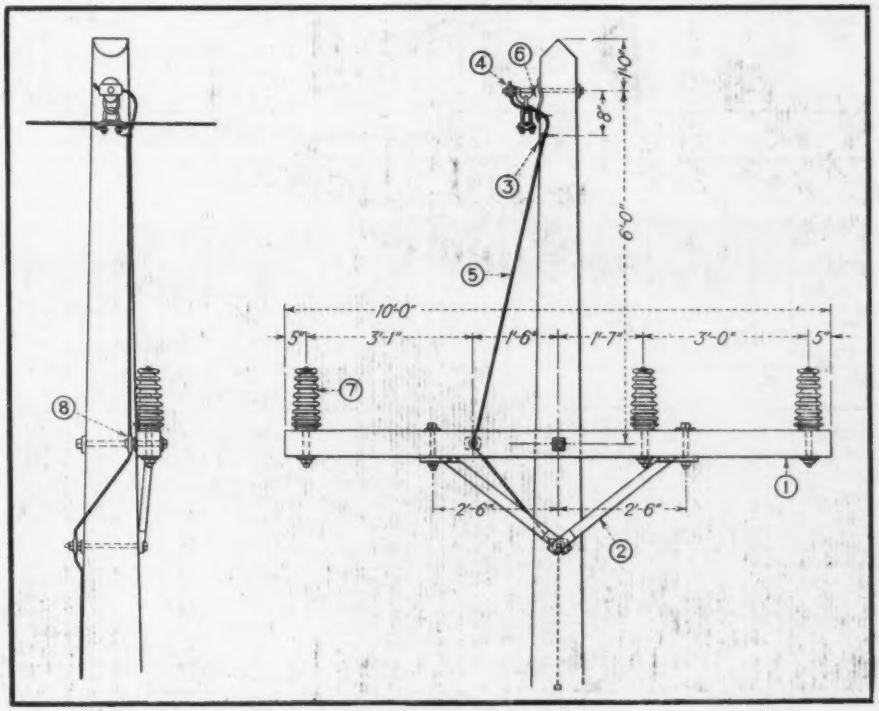
33-Kv. Construction, Lightning-Free Operation

Virtual doubling of the distance between ground wire and conductor, use of wooden crossarm braces and other details of construction on a 33-kv. line in a bad storm area of the New York State Electric & Gas Corp. resulted no outages due to lightning in three years of operation. Other lines parallel to this 13-mile Copperweld circuit have eight or nine operations per year due to lightning.

The ground wire is brought away from the pole at the ground wire lag screw and attached to the crossarm by a machine bolt 1½-ft. from the pole center-line. This increases the distance between the middle conductor and the ground wire from 1 ft. 7 in. to 3 ft. 1 in.

Wooden crossarm braces also remove metal from the middle conductor area. Lag screw (No. 3 on the sketch) is offset 45 deg. with respect to the suspension clamp to reduce the sharp angular takeoff of the ground wire. All metal bolts and screws on the pole are connected to the ground wire if the flashover distance is not decreased in so doing. This affords ground potential to all metal parts and prevents lightning from splintering and burning the pole.

One additional but unrelated feature on this line is the use of Everdur Palnuts on all bolts to prevent loosening and thereby prevent radio interference.



DETAILS OF POLE-TOP CONSTRUCTION on lightning-free line. Item No. 1, 10-ft. wood crossarm; 2, wood crossarm brace; 3, ground wire lag screw; 4, ground wire clamp for ⅝-in. bolt; 5, No. 2, bare, solid, S.D. copper ground wire; 6, swing link ground wire bracket; 7, Lapp insulator No. 9435; 8, ground wire clamp for ½-in. bolt

HOW TO DETERMINE STEAM REQUIREMENTS FOR TURBINE-GENERATOR UNITS

F. K. FISCHER and J. R. CARLSON, Central Station Steam Engineering,
Westinghouse Electric Corp., South Philadelphia, Pa.

Accompanying table provides approximate steam consumption, at rated load, for turbine-generator units in capacities 20,000 to 60,000 kw. hydrogen cooled and for initial steam conditions 1,250-lb. gage, 950 deg. F. Straight condensing and closely approximate feed-water heating data are listed for three common conditions of vacuum operation. Similar tables for 400-lb. gage, 750-deg. F., and 600-lb. gage, 825-deg. F. steam appeared in "Electrical World," September 1, 1945, page 116, and for 850-lb. gage 900-deg. F. steam in September 15, 1945, page 128. A subsequent issue will present a method for determining heat consumption rates for other steam conditions.

For economic analyses the accompanying table provides following information for rated load:

Straight Condensing Operation—(1) Steam rate; (2) Steam flow to turbine; (3) Steam flow to condenser; (4) Heat rate.

Feed-water Heating Operation—(1) Steam flow to turbine; (2) Steam flow to condenser; (3) Final feed-water temperature; (4) Heat rate.

Example

Determine the performance of a 40,000-kw., hydrogen-cooled turbine-generator unit designed to operate at 1,250-lb. gage, 950 deg. F., steam, 2.0 in. Hg absolute exhaust pressure, and having four and five stages of feed-water heating.

Refer to the table and obtain the following data:

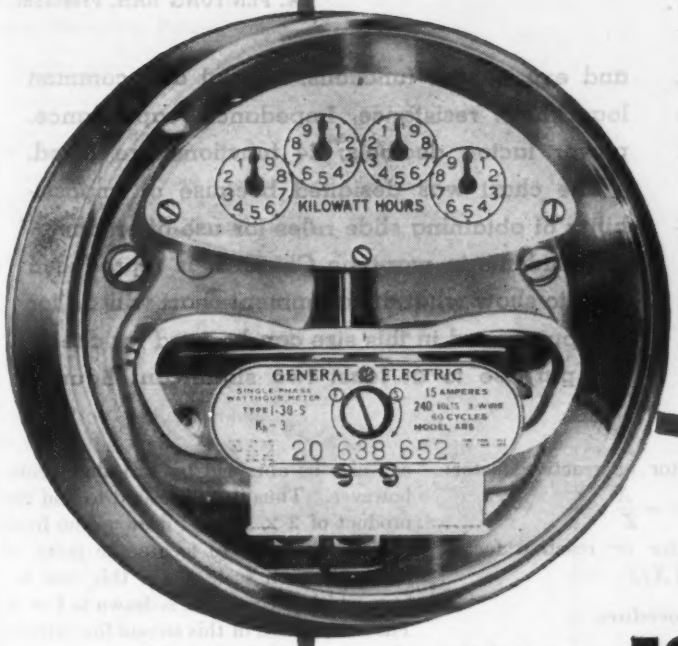
Item	4 stages	5 stages
Steam flow to turbine, lb./hr.	350,000	355,300
Steam flow to condenser, lb./hr.	249,200	247,600
Heat rate, Btu./kw.-hr.	9,170	9,120
Final feed-water temp. deg. F.	441	460

Approximate Steam Consumption for Turbine-Generator Units

(At Rated Load and at Various Steam Conditions)

Rating, kw.	No. Stages Feed-Water Heating	1.0 in. Hg Exhaust Pressure					1.5 in. Hg Exhaust Pressure					2.0 in. Hg Exhaust Pressure				
		Rated Load Steam Rate, lb./kw.-hr.	Final Feed-Water Temp., deg.F.	Steam to Turbine, 1,000 lb./hr.	Heat Rate, Btu./kw.-hr.	Steam to Condenser, 1,000 lb./hr.	Rated Load Steam Rate, lb./kw.-hr.	Final Feed-Water Temp., deg. F.	Steam to Turbine, 1,000 lb./hr.	Heat Rate, Btu./kw.-hr.	Steam to Condenser, 1,000 lb./hr.	Rated Load Steam Rate, lb./kw.-hr.	Final Feed-Water Temp., deg.F.	Steam to Turbine, 1,000 lb./hr.	Heat Rate, Btu./kw.-hr.	Steam to Condenser, 1,000 lb./hr.
Steam Conditions: 1,250-lb. Gage, 950 deg. F.																
Single Casing Units																
20,000	0	7.57	79.0	151.4	10,760	151.4	7.67	91.7	153.4	10,800	153.4	7.77	101.1	155.4	10,870	155.4
	3		395	173.1	9,510	127.1		408	176.5	9,580	129.6		417	179.7	9,660	131.9
	4		419	175.9	9,430	125.2		432	179.4	9,500	127.7		441	182.8	9,580	130.2
	5		438	178.3	9,370	124.3		451	182.1	9,440	126.9		460	185.5	9,520	129.3
25,000	0	7.48	79.0	187.0	10,630	187.0	7.58	91.7	189.5	10,680	189.5	7.67	101.1	191.8	10,730	191.8
	3		395	213.9	9,400	157.0		408	218.1	9,460	160.1		417	221.8	9,530	162.8
	4		419	217.2	9,320	154.6		432	221.7	9,380	157.9		441	225.5	9,450	160.6
	5		438	220.3	9,260	153.5		451	224.9	9,330	156.8		460	229.0	9,400	159.6
Tandem Compound Units																
30,000	0	7.33	79.0	219.9	10,420	219.9	7.42	91.7	222.6	10,450	222.6	7.51	101.1	225.3	10,510	225.3
	3		395	251.5	9,210	184.6		408	256.2	9,260	188.1		417	260.6	9,330	191.3
	4		419	255.4	9,130	181.8		432	260.4	9,190	185.4		441	265.0	9,260	188.7
	5		438	259.0	9,080	180.5		451	264.2	9,130	184.1		460	269.0	9,200	187.5
35,000	0	7.28	79.0	254.8	10,340	254.8	7.38	91.7	258.3	10,390	258.3	7.47	101.1	261.4	10,450	261.4
	3		395	291.4	9,140	213.9		408	297.2	9,210	218.1		417	302.4	9,280	222.0
	4		419	295.9	9,070	210.7		432	302.1	9,140	215.1		441	307.5	9,210	218.9
	5		438	300.1	9,020	209.2		451	306.5	9,080	213.6		460	312.2	9,160	217.6
40,000	0	7.25	79.0	290.0	10,300	290.0	7.35	91.7	294.0	10,350	294.0	7.44	101.1	297.6	10,410	297.6
	3		395	331.6	9,110	243.4		408	338.3	9,180	248.3		417	344.2	9,240	252.6
	4		419	336.8	9,030	239.8		432	343.9	9,100	244.9		441	350.0	9,170	249.2
	5		438	341.6	8,980	238.1		451	348.9	9,050	243.2		460	355.3	9,120	247.6
50,000	0	7.22	79.0	361.0	10,260	361.0	7.32	91.7	366.0	10,310	366.0	7.41	101.1	370.5	10,370	370.5
	3		395	412.9	9,070	303.1		408	421.2	9,140	309.2		417	428.5	9,210	314.5
	4		419	419.3	8,990	298.5		432	428.1	9,060	304.8		441	435.8	9,130	310.3
	5		438	425.2	8,940	296.4		451	434.4	9,010	302.8		460	442.4	9,080	308.4
60,000	0	7.19	79.0	431.4	10,220	431.4	7.30	91.7	438.0	10,280	438.0	7.39	101.1	443.4	10,340	443.4
	3		395	493.4	9,030	362.2		408	504.1	9,110	370.0		417	512.8	9,180	376.4
	4		419	501.1	8,960	356.8		432	512.3	9,040	364.8		441	521.6	9,110	371.4
	5		438	508.1	8,900	354.1		451	519.9	8,990	362.4		460	529.4	9,060	369.0

You can count on the



I-30

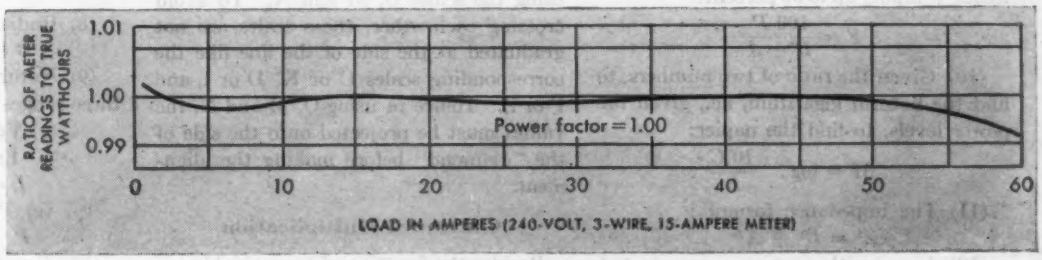
FOR INHERENT ACCURACY ON HEAVY LOADS

During the last few years, load growth has done more than anything else to prove the inherent accuracy of the I-30 watthour meter.

Inherent accuracy on heavy loads is made possible by low nominal speed and low useful current flux, which effectively overcome the error tendency of the damping torque.

Features such as these have characterized General Electric watthour meters for many years and are the basis of the long-range accuracy of I-30 meters. Include the I-30 in your metering program. It's the safe thing to do. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

WATTHOUR METERS



Headquarters for Electrical Measurement

BUY WAR BONDS

GENERAL ELECTRIC

601-16-6110

"DIAMOND SEVEN" CHART* FOR

A. PEN-TUNG SAH, President, National

Combination nomographic and mathematical chart* (on opposite page) consists of seven lines of the same length arranged in the form of a diamond, hence the name "Diamond Seven." Lines have scales giving directly the function of a single variable, or by alignment, the function of two variables.

Chart can be used for addition or subtraction, multiplication or division, solving trignometrical and exponential functions, natural and common logarithms, resistance, impedance, capacitance, power factor, decibels; 24 functions are listed.

The chart was designed because of impossibility of obtaining slide rules for use of engineering students in war-time China. It is reproduced here to show what the alignment chart will do for computers and in this size can be used for checking purpose to at least two significant figures.

Functions of Two Variables

To find the function of two variables, the principle of an alignment chart or nomograph is used. Following 14 relations may be read by such an alignment:

(1) Addition or subtraction:

$$J = P + U$$

(2) Multiplication or division: $B = CD$

(3) Given two legs of a right triangle, to find the acute angle: $T = \tan^{-1} \frac{C}{10\,I}$

(4) Given the damping constant and the angle, to find the damped sinusoid:

$$X = 10\, e^{-(N/2)} \sin Y$$

(5) Given the ratio of two numbers, to find the common logarithm, i.e., given the power levels, to find the decibel:

$$Q = 100 \log \frac{B}{D}$$

(6) Given the base and the positive exponent, to find the number, up to $E = 3$: $K = I^E$

(7) Given the base and the negative exponent, to find the number, up to $E = 3$: $K = (D/10)^{-E}$

(8) Lens formula, or resistances in parallel, or condensers in series:

$$\frac{1}{F} = \frac{1}{P} + \frac{1}{Q}$$

(9) Given output and loss, to find efficiency or deficiency (deficiency = losses + input) up to 50 percent:

$$F = \frac{100\,P}{P + J}$$

(10) Given the ratio of two numbers, to find the natural logarithm, i.e., given the power levels, to find the napier:

$$M = \log_e \frac{10\,C}{B}$$

(11) The impedance formula:

$$Z^2 = R^2 + X^2$$

(12) Area within two concentrated circles of given radii: $A = \pi\,(Z^2 - X^2)$

(13) Power factor or reactive factor:

$$S = \frac{X}{Z}$$

(14) Power factor or reactive factor angle: $Y = \sin^{-1}(X/Z)$

Procedure

Procedure for finding any one of the above 14 functional relations is as follows:

(A) From the left-hand set off 14 blocks summarizing the scales for alignment, select the three scales corresponding to the required formula or operation.

(B) Connect the two given numbers on two of the scales by a straight line, using a straight edge, or a transparent celluloid triangle, or a thread.

(C) Find the required answer at the point of intersection of the straight edge with the third scale.

Example

To find the product of 2 and 3. The second block shows that the scales B, C and D are involved. The direction of these scales show that they are parallel lines running from the right downwards to the left. The formula is $B = CD$. Thus connecting the point C = 2 to the point D = 3 by a straight line, find from the intersecting point B = 6.

(D) One precaution is to be noted in using the scales Q, M and N. To avoid crossing each other, these scales are not graduated at the side of the line like the corresponding scales C or K, D or I, and P or Z. Hence in using Q, M and N, the values must be projected onto the side of the "diamond" before making the alignment.

Continued Multiplication

Besides the function of two variables as given above, the product of three numbers can also be obtained by two alignments, however. Thus if it is desired to find the product of $2 \times 3 \times 0.4$ draw a line from C = 2 to D = 3 to locate the point of intersection on scale B (in this case 6), from which a second line is drawn to I = 4. The intersection of this second line with C gives the answer as 2.4.

Mathematical Charts

The direct reading scales summarized in the blocks in the right-hand inset are convenient three-place mathematical tables. From these the most useful functions of a single variable are easily obtained. There are ten functions as follows:

(1) Reciprocals: $D = \frac{10}{I}$

(2) Squares and square roots:

$$X = \sqrt{J}, \quad P = Z^2$$

(3) Cube and cube roots: $K = C^3$

(4) Radius and area of circle: $A = \pi R^2$

(5) Sine of angles in three ranges:

(a) Less than 10°, $B = 100 \sin T°$

(b) Between 10° and 65°,

$$S = \sin Y°$$

(c) Between 65° and 90°, $H = \sin J^0$

(6) Tangent of angles up to 45°:

$$B = 100 \tan T°$$

(7) Complementary angles:

$$G + J = 90°$$

(8) Radian measure and degree:

$$B \text{ (radians)} = 100\, T°$$

(9) Natural logarithms of numbers in three ranges:

(a) From $L = 2.3$ to 4.5, $U = e^L$

(b) From $M = 0$ to $\pm$ 2.3, $I = e^M$, $D = 10\, e^{-M}$

(c) From $N = 4$ to 0, $P = 100\, e^{-N}$, $Z = 10\, e^{-(N/2)}$

(10) Common logarithms,

$$Q = 100 \log C$$

* Adapted from forthcoming book "Fundamentals of A-C Machines" to be published by McGraw-Hill Book Co., New York.

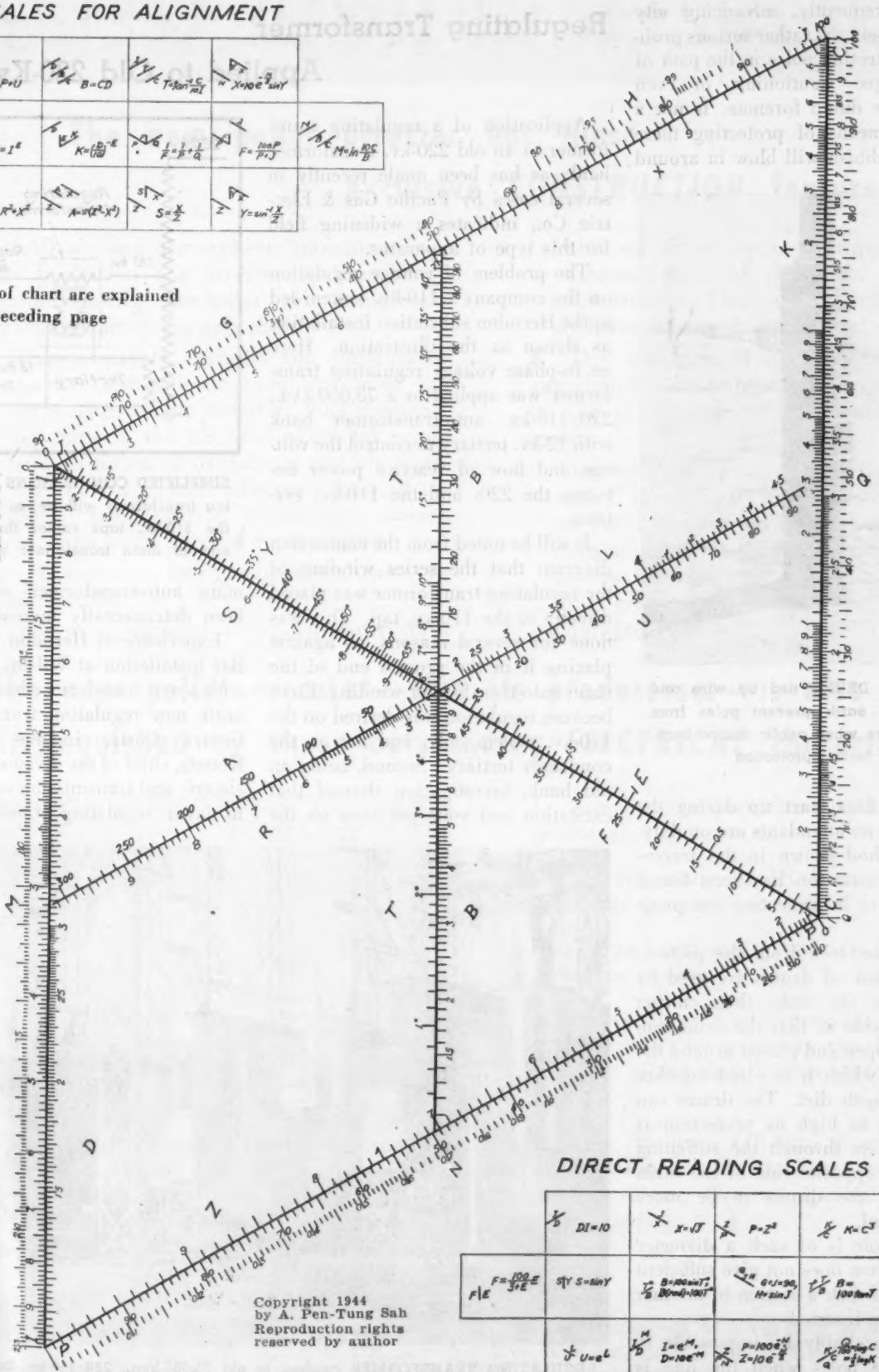
ECTRICAL COMPUTATION

ity of Amoy, Changting, Fukien, China

SCALES FOR ALIGNMENT

$J=P+U$	$B=CD$	$T=\sin^{-1}\frac{C}{nL}$	$X=10E^{\frac{B}{100}\sin Y}$
$\log\frac{B}{100}=\log\frac{B}{D}$	$K=I^E$	$K=\left(\frac{B}{100}\right)^E$	$\frac{1}{F}=\frac{1}{P}+\frac{1}{Q}$	$F=\frac{100P}{P+J}$	$M=\ln\frac{100C}{B}$
$Z^2=R^2+X^2$	$A=\pi(R^2-X^2)$	$S=\frac{X}{Z}$	$Y=\sin^{-1}\frac{X}{Z}$		

Uses of chart are explained on preceding page



For the sake of making the chart as large as possible it was separated from the combination indicated in the accompanying diagrams. All the relations remain the same, however.

DIRECT READING SCALES

	$D=10$	$X=\sqrt{T}$	$P=Z^2$	$K=C^3$	
$F=\frac{100E}{3+E}$	$S=\sin Y$	$B=100\sin T$, $D=100\cos T=100T$	$G=90$, $H=\sin J$	$B=100\tan T$	$A=\pi R^2$
	$U=e^L$	$I=e^M$, $D=10e^M$	$P=100\frac{N}{2}$, $Z=10^{\frac{N}{2}}$	$\frac{K}{3}=\log C$, $L=\frac{1}{3}\log K$	

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Can Protect Poles from Rubbish Fires

PAUL B. HULL

Assistant Superintendent of Electric Distribution
Public Service Co. of Colorado, Denver

Quite frequently, advancing city dumps present the rather serious problem of protecting poles in the path of such dumps. Cautioning, or even bribing the dump foreman, is not a sure fire means of protecting these poles as rubbish will blow in around

SPLIT OIL DRUMS tied by wire and filled with earth prevent poles from catching fire when public dumps burn, stacked for further protection

them and fires start up during the night when no attendants are on duty.

The method shown in the accompanying illustration has been found very effective in protecting our property.

As can be seen from the picture, old discarded oil drums are used by cutting out the ends, then cutting down one side so that the drum can be spread open and placed around the pole, after which it is wired together and filled with dirt. The drums can be stacked as high as protection is desired. Cuts through the stiffening rib on the opposite side of the main cut allows the drums to be more easily spread.

If the pole is of such a diameter that one drum does not give sufficient thickness of dirt, a section of another one may be inserted.

It will probably be impossible to remove the poles when the line is rebuilt to give sufficient clearance over the new dump level, but this is a small item compared to a pole burning off and thus interrupting service to a large section of the city.

This method, on our system, was developed by Harry L. Wickstrom, Superintendent of Electric Distribution Operations, and his associates.

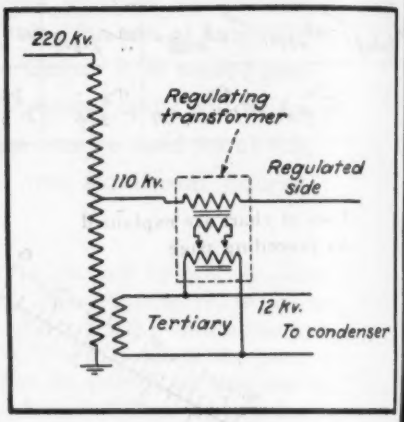
• • •

Regulating Transformer Applied to Old 220-Kv. Bank

Application of a regulating transformer to an old 220-kv. transformer bank, as has been made recently in several cases by Pacific Gas & Electric Co., indicates a widening field for this type of apparatus.

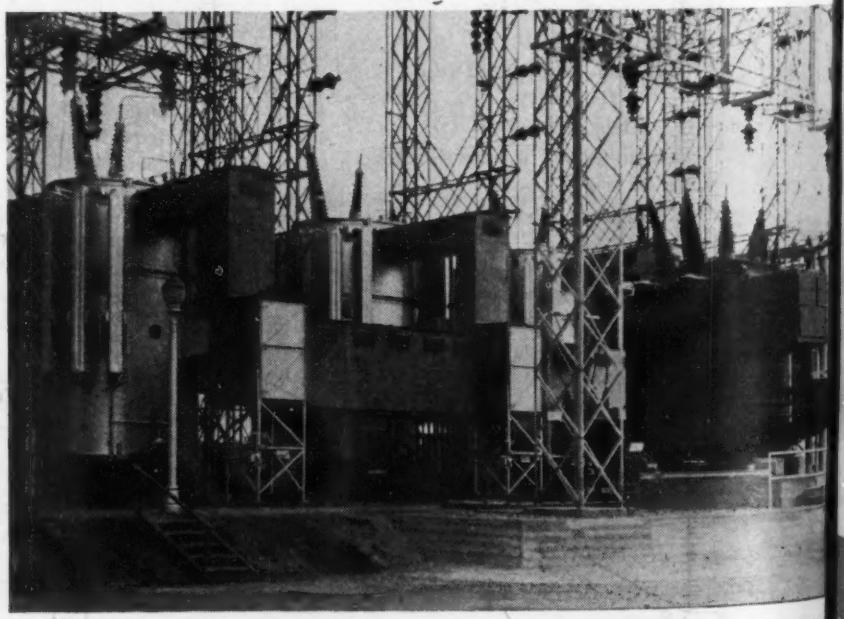
The problem of voltage regulation on the company's 110-kv. system led to the Herndon substation installation as shown in the illustration. Here an in-phase voltage regulating transformer was applied to a 75,000-kva., 220/110-kv. auto-transformer bank with 12-kv. tertiary to control the voltage and flow of reactive power between the 220- and the 110-kv. systems.

It will be noted from the connection diagram that the series winding of the regulating transformer was placed directly in the 110-kv. tap. This was done for several reasons, as against placing it in the ground end of the main auto-transformer winding. First, because regulation was desired on the 110-kv. system only, and not on the condenser tertiary. Second, being an old bank, investigation showed that excitation and volts per turn on the main auto-transformer would have been detrimentally increased.



SIMPLIFIED CONNECTIONS of regulating transformer with series winding in the 110-kv. taps rather than ground end of main transformer winding

Experience at Herndon and a similar installation at Wilson, as well as with a new transformer bank and separate new regulating transformer at Contra Costa, inclines John A. Koontz, chief of the division of hydroelectric and transmission engineering, to favor regulating transformers as



REGULATING TRANSFORMER applied to old 75,000-kva., 220/110-kv. bank solves voltage regulation problem on the 110-kv. system

N_2-Filled gap chamber assures A NEW HIGH IN RELIABILITY

The *new* pellet arrester has these exclusive *CONSTRUCTION* features:

1. All air and atmospheric moisture (usually sealed in the arrester with *ordinary* manufacturing methods) are completely evacuated from the gap chamber.

This positively excludes the moisture of normal atmospheric humidity from the series gaps of the arrester, thus eliminating oxygen, the essential agent for ozone and all forms of oxidation, and eliminating the recognized adverse effects of internal condensation ("dewing") caused by changes in outdoor temperature.

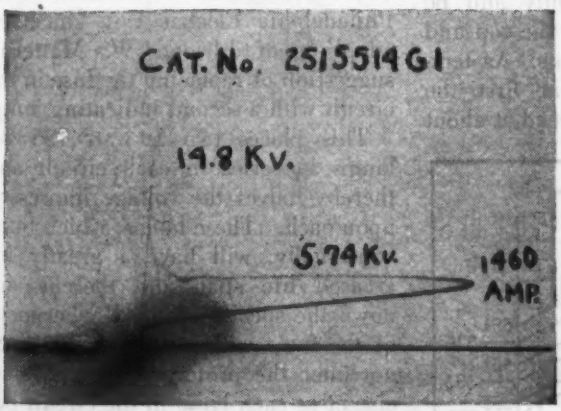
2. A vacuum test assures tightness of gasket seals.

The evacuation of air and moisture provides an error-proof, routine, vacuum-withstand test of the main sealing of each arrester. Thus, any unit having the slightest leak is detected and rejected.

3. Dry nitrogen (N_2) is injected into the gap chamber, and the small "treating" hole in the metal cap is immediately solder-sealed.

The injected dry-nitrogen permanently sealed in the gap chamber is *inert*. It prevents the formation of any ozone or oxides; keeps the gap electrodes bright as new during years of service operation, and gives more stable gap-sparkover characteristics.

The *new* pellet arrester—like its predecessor—is also distinguished by these outstanding *ELECTRICAL* characteristics:



The excellent impulse protective characteristics of pellet arresters *stay excellent*. Here is an oscillogram of a 3-kv pellet arrester *after 18 years of continuous service operation*. The arrester was manufactured in 1924.

1. Low impulse breakdown voltage to start discharge.

2. Exceptionally low IR drop, even at high discharge currents.

3. Large discharge capacity for severe lightning strokes.

4. Valve action; no exposed live parts or arc flame. Pellet arresters can be used on *any* part of *any* distribution system, rural or urban.

Ask for Bulletin GEA-2975 for complete information on G-E pellet arresters. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

separate units under certain conditions rather than tap changing built into the main transformers, from the standpoint of reliability of the main bank. This is especially true when using auto-transformers. With separate units the regulating transformer can quickly be bypassed in case of trouble without tying up the main transformers.

•

Drying Transformers*

III—Insulation Resistance

W. C. SEALEY

Engineer in Charge of Design, Transformer Section, Allis-Chalmers Mfg. Co., Milwaukee, Wis.

In drying transformer cores and coils the determination of insulation resistance is important as an index of the status of drying only when the transformer is without oil. When the transformer is dried under oil another method is used which has already been discussed in the first article of this series.

If initial insulation resistance is measured at ordinary temperature it may be high even though the insulation is not dry. As the transformer is heated up, however, the presence of moisture will be evidenced by a rapid drop in insulation resistance. As drying proceeds at constant temperature, resistance will increase gradually until the end of the drying period, when it will increase more sharply.

Since insulation resistance varies greatly with temperature, the temperature during drying should be held as constant as possible so that resistance measurements will be made under uniform conditions. Insulation resistance in megohms varies inversely with the temperature. For an 8-10 deg. C. change in insulation temperature the insulation resistance in megohms changes by a ratio of about 2:1. Measurements should be made every two hours during the drying period and should be taken with all windings grounded except the one being tested.

A curve of insulation resistance measurements should be plotted with time as abcissa and resistance as ordinate. By observation, the knee of the curve (point where insulation resistance begins to increase more rapidly) can be determined and the run should continue until constant for 12 hours at a value as great or greater than given by the accompanying chart and formula below. Megohms resistance of one phase at 85 deg. C. in air or at 40 deg. C. in oil

$$= \frac{15 \times kv.\ test}{\sqrt{\frac{kva.}{cycles}}}$$

where

kv. test = low frequency dielectric test of winding expressed in kilovolts.
kva. = kva. of transformer per phase.

As drying temperature approaches the point where fibrous materials deteriorate, care must be exercised to see that temperature does not exceed 85 deg. at any point. Thermometers should be used abundantly and be placed among coils near the top and screened from air currents. As temperature rises rapidly at first the thermometers should be read at about half-hour intervals. Wherever possible the temperature should be checked by the increase in resistance method.

* Part III of a three-part series.

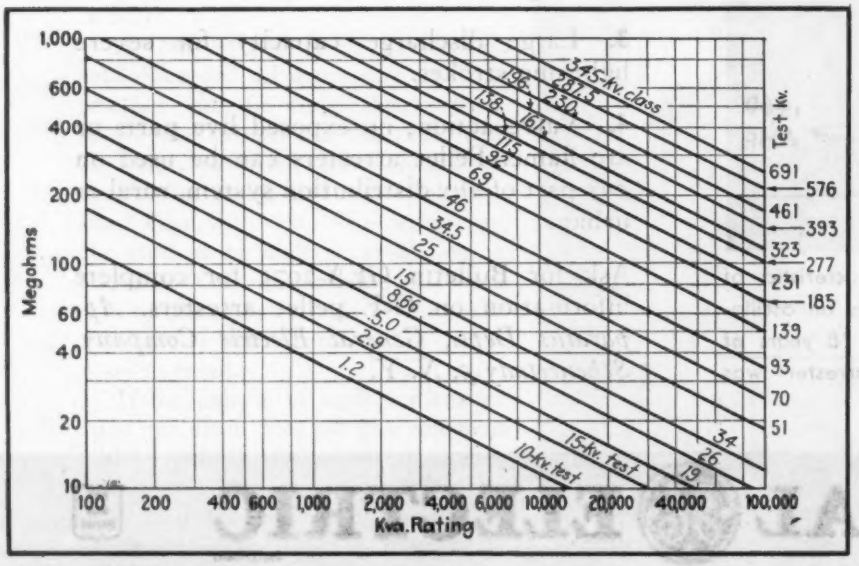
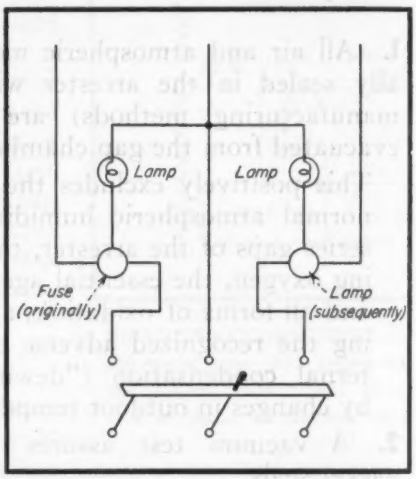


CHART GIVES minimum transformer insulation resistance at 85 deg. C. in air or 40 deg. C. in oil, can be used in conjunction with formula in text

•

Trouble Trips Reduced for Meter Servicemen

Many a visit to the customer's premises has been made in the past to determine whether trouble actually existed in the meter potential transformer circuit when the indicating lamp was not burning or whether the lamp was merely burned out. These special trips will not be as frequent now for the meter service man in the Philadelphia Electric Co., since the adoption of Elwood W. Mattern's suggestion of replacing the fuse in the circuit with a second indicating lamp.



REPLACING two fuses with two 10-watt 125-volt indicating lamps in Tesco box increases lamp life

This places two 10-watt 125-volt lamps in series in each circuit and thereby halves the voltage impressed upon each. These lamps, which burn continually, will have a greatly increased life span and thereby cut down the special trips. Replacement of the fuses with 10-watt lamps does not alter the protection of the lamp circuit as each lamp in the circuit becomes a protective element.

•

Apparatus Finds Rate of Corrosion

An accelerated, total-immersion corrosion test has been developed which can be used to evaluate either metal or solutions and which allows for considerable variation of conditions. The solution is circulated by

The green light in metals... Revere has them NOW

Revere knows well how precious to the nation each of these post-war days can be, and how crippling to industry and employment could be a shortage of essential metals. That is why, since V-J Day, Revere has been in full production for peace.

Fortunately, Revere metals can serve the needs of creating as well as those of destroying, can make as fine bathroom fixtures as bomb fuses, as excellent radiators for automobiles as for half-tracks. No difficult reconversion problems have stifled the outpouring of Revere metals.

Revere copper, brass, bronze, aluminum, magnesium, steel, are ready *now*, are already busy in thousands of plants helping shorten the period of reconversion for industry and for the nation.

We are able and eager to do more. One inevitable result of Revere's war effort has been that not only our ability to produce, but our ability to give service, have been expanded many times. Revere research has probed further and deeper. Revere Technical Advisors are armed with greater knowledge and experience. New methods, metals and machines may save precious time or cut all-important cost for users of our metals.

In all these ways Revere is ready *now* to serve the manufacturing and building industries to help you prove *immediately* that America is even greater in peace than she proved to be in war. In the same way Revere is ready to serve home owners with its building products which are stocked by Revere Distributors in all parts of the country.

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The Revere Office nearest you is at your service.

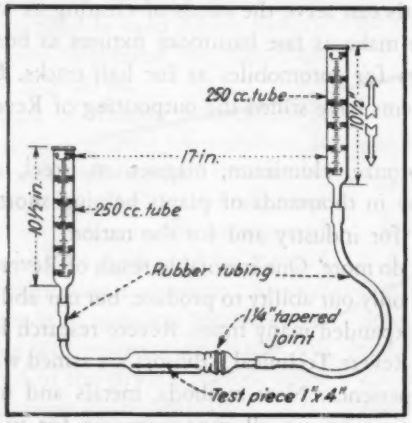
Listen to the Human Adventure on the Mutual Network every Wednesday evening, 10 to 10:30 P. M., Eastern Time

moving one of the vertical tubes up and down. (See figure). This is described by Morris Cohen in a recent Electrochemical Society paper entitled "An Apparatus For Measuring Corrosion."

The test piece is inserted through the tapered joint which is closed and sealed, using a thin layer of a highly water-repellent grease, a thick mixture of petrolatum and lithium stearate. The panel rests on its edges on the glass tube. The speed of rocking can be adjusted by the sizes of the pulleys on the motor and gear reducer. The rubber tubing is a semi-pressure tubing which gives good flexing without kinking. The longer piece is 16 in. long.

The test pieces used were 24 gage (0.64 mm.) thick, 4-in. by 1-in. steel panels cut from bright, cold-rolled automobile-body steel.

By attaching tubes to the test-piece



SEVERAL SUCH connected tubes (left stationary, right movable, in vertical plane with travel adjustable used to measure corrosion resistance

holder it would be easy to renew the solution, if that were desirable. It would also be possible to run tensile-test specimens by lengthening the test-piece tube or to control the atmosphere by running attachments to the 250-cc. tubes.

•

Rural Voltage Drop

Although the typographical error in "How to Determine Voltage Drop on Rural Lines" (ELECTRICAL WORLD, August 18, 1945, page 130) was undoubtedly obvious to most readers, attention is called to the fact that the fraction line in the voltage drop formula should have begun at the right of the equality sign and should not extend to the left under "percent voltage drop in section."

No Line Truck Has Too Many Drawers

To make the best possible use of space in the side compartments of its line trucks Wisconsin Gas & Electric Co. equips them with banks of metal drawers as shown above. The 18 small drawers, each 5½ by 10½ by 2¾ in., can be divided into compartments and are used to store such

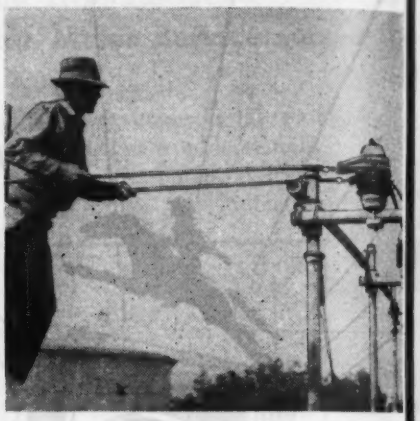
CHESTS OF DRAWERS on line trucks

items as splicing sleeves, staples, connectors, house knobs, three-bolt guy clamps, automatic line splices, pole tags and a few hundred other small items. Drawers were made by Lyon Metal Products, Inc. The two larger drawers (23 by 11 by 4 in.) carry spacer and through-bolts, etc., and were provided with the body by American Coach & Body Co.

•

"Shoe Shine" Technique Cleans Insulators

Wartime industrial activity has brought new problems to Southern California Edison Co. in cleaning air-borne dust, dirt and chemical deposits from line and substation insulators. One of several methods used is that illustrated where a hard-woven, burlap, hammock-shaped, wiping cloth is attached to hot sticks and a shoe shine motion used to effect the cleaning. Surface of the insulator toward the man is cleaned by crossing the sticks, which brings the hammock all the way around the insulator. Sticks used are specially treated, 7 to 10 ft. long.



CLEANING SUBSTATION insulators with burlap wiping cloth attached to hot sticks; shoe-shine motion used

Various types of ladders and scaffolds are used to enable the man to get into an advantageous working position. A supervisor on the ground gives full attention to the man working to see that he keeps a safe distance from "hot stuff."

•

Flashlight Becomes A Testing Device

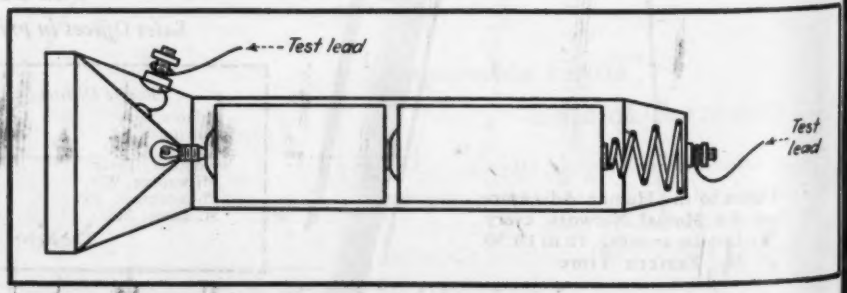
A. R. CONSTANT, JR.

New England Power System, Tewksbury, Mass.

For checking switchboard wiring and other tests on low resistance circuits it is convenient to convert an ordinary two-cell flashlight into a test unit.

A lamp having a plastic case is essential to the job, which involves adding a test terminal at each end of the case, connected as indicated.

To prepare the flashlight for this purpose two holes are drilled in the case, one being through the center of the end piece and the other on the

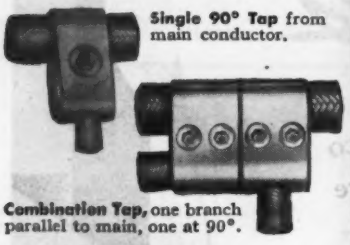


METHOD OF CONVERTING flashlight into a test unit

PLAN NOW TO REDUCE POST-WAR OPERATING COSTS WITH
PHILCO
Floté Batteries
Lower operating cost is an important advantage of Philco Floté Storage Batteries. The rugged, long-life structure of the famous Philco Floté grid is cast in a special high-efficiency metal which reduces internal losses. With Philco, low cells are eliminated in full float service. There is a Philco Battery for every control and auxiliary power requirement. Write today for latest catalogs.
Typical Philco Floté Battery in Steel Glass Jar.
PHILCO
Famous for Quality the World Over
PHILCO CORPORATION
STORAGE BATTERY DIVISION, TRENTON 7, NEW JERSEY
FOR 50 YEARS A LEADER IN INDUSTRIAL STORAGE BATTERY DEVELOPMENT

It's Easy to pick the right CABLE TAP— from the *Complete* line

You'll find the widest variety of parallel and 90° taps, combinations, and gutter taps—in a range of sizes up to 1,000,000 cm. Insulating Bakelite covers can be furnished for all types.



Single 90° Tap from main conductor.

Combination Tap, one branch parallel to main, one at 90°.

2-Way Gutter Tap.

Bakelite Covers can be furnished for all types of Penn-Union cable taps.

3-Way; continuous main and two separate branches.

Also a complete line of Service Connectors, Terminals, Tees, Straight and Parallel Connectors, Grounding Connectors, etc. — every good type of conductor fitting. And every one is accurately made, thoroughly tested — *dependable.*

PENN-UNION ELECTRIC CORPORATION ERIE, PA.

PENN-UNION
Conductor Fittings

slanting portion of the head piece. These holes accommodate screws 6/32 in. in diameter and ½ in. long. Light flexible wires 3 in. long are soldered to the washer side of the head of the screw, the screws being held firmly in place by nuts. The wire going to the negative side of the battery may be soldered either to the spring which makes contact with the battery, or to the metallic threaded portion of the unit. The conductor going to the positive end of the battery may be soldered either to the dull side of the reflector or to the threaded metallic portion which holds the bulb.

A second nut allows forked terminal jumpers to be rigidly held while probing is done with the other end of the leads. When the test is finished, the leads are removed from the terminal nuts so as not to interfere with the normal use of the flashlight. The scheme is useful only on resistance circuits.

Outside limit of circuit resistance is 10 ohms for tests with a 2-cell flashlight. A feeble glow is obtained on 10 ohms but below this value the glow of the lamp is more evident.

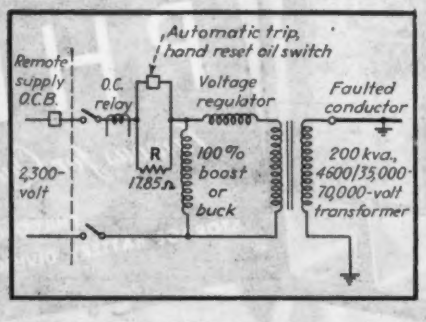
•

Self-Protected Device Carbonizes Cable Faults

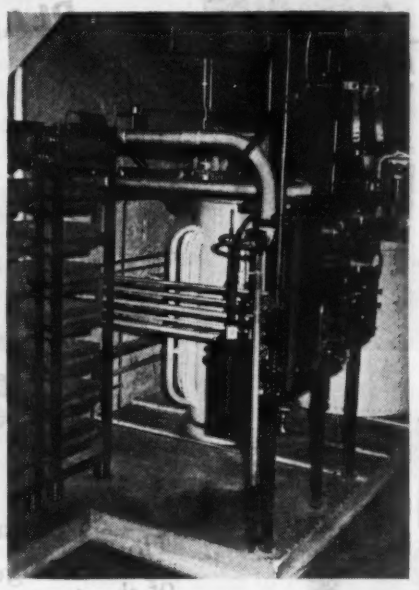
T. G. HIERONYMUS
Supt. Underground Lines
Kansas City Power & Light Co.,
Kansas City, Mo.

For reducing a cable fault to a low-resistance ground, for ready location using a low-voltage L & N type d.c. slide-wire bridge or other means, Kansas City Power & Light Co. uses special reducing apparatus that will pump a certain maximum current into the faulted cable until complete carbonization occurs.

This equipment, located permanently at Grand Avenue station, is self-protecting. It is designed to limit the current pumped into a cable fault, for breakdown purposes, to 200 percent of the rating of the transformer equipment supplying the breakdown current.



CIRCUIT DIAGRAM of device used to carbonize the insulation at cable faults. O.C. relay trips short-circuiting switch to limit burndown current to 200 percent of transformer rating



CABLE FAULT reduction apparatus installed in generating station burns cable faults to low-resistance ground for easy location. Resistor is at left; regulator visible behind switch panel

It offers distinct operating advantages over the conventional method of reducing a fault where instantaneous trip breakers are used in order to protect the test transformer from overload. In the conventional method the breaker generally trips out the test transformer the instant the fault flashes over, often without carbonizing and especially if the fault is in a joint that has blown open at the top allowing the filling compound to reseal the fault.

The apparatus shown keeps the arc going at the fault at a reduced voltage without interruption until the faulty conductor insulation is well carbonized.

Circuit of the apparatus is shown. Breakdown current is fed into the fault from the high-voltage secondary of a 200-kva., 4,600/35,000-70,000-volt transformer. The low-voltage primary of the transformer is supplied at 2,300 volts. A voltage regulator providing 100 percent boost or buck in the primary circuit voltage permits adjustment of the transformer output voltage to the desired value.

The current limiting feature of the design is achieved by the use of an overcurrent relay in the supply cir-

Empty Sockets you FILL 'em . . .

2 General Electric newspaper ads are telling your customers that G-E Lamps are "Back Again!" These ads, helping to fill empty sockets in your territory are appearing in 188 newspapers in 114 cities. In addition to these millions of advertising messages, the General Electric Hour of Charm, each Sunday, reaches more millions of your customers.

BACK AGAIN!
Now you can get the G-E LAMPS you've been wanting!
Take home the types and sizes you need for Better Light.
Prices as low as 10¢
Stay Brighter Longer!
G-E LAMPS
GENERAL ELECTRIC
COME BACK!
10¢
G-E LAMPS

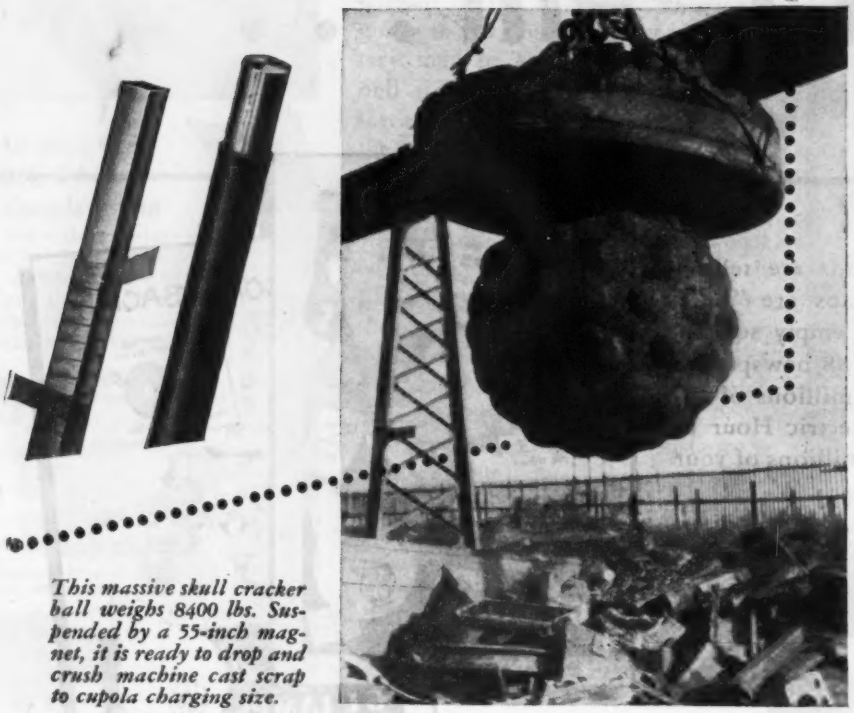
3 Why not take advantage of this big advertising campaign? Why not make it *your* advertising? General Electric has prepared for you a complete Empty Socket campaign—"100,000,000 Empty Sockets." It's ready now . . . with all the facts and promotional material you need! Ask your G-E Lamp Representative to show it to you today!

G-E LAMPS

GENERAL ELECTRIC

A TOUGH, HOT JOB FOR MAGNET WIRE

CALLS FOR DELTABESTON



This massive skull cracker ball weighs 8400 lbs. Suspended by a 55-inch magnet, it is ready to drop and crush machine cast scrap to cupola charging size.

SUCH applications require great current densities and generate high heat. That's why industrial plants protect their electrical equipment with Deltabeston Asbestos-insulated or Deltaglass Magnet Wires. Despite severe operating conditions of high conductor heat and extreme weathering, the varnished asbestos or glass insulation remains unimpaired.

Deltabeston and Deltaglass are ideal for safeguarding motors against high ambient temperatures and overload heat because the impregnated asbestos or varnished glass yarn insulations just won't bake out. These heat-resistant magnet wires are used extensively for winding armatures, field coils, stator windings, magnetic brakes, welding equipment, lifting magnets, industrial controls and solenoids. Both Deltabeston and Deltaglass are available in round, square and rectangular shapes covering a complete range of sizes.

Do you have a magnet wire problem where heat or moisture prevail? You can obtain additional information by writing to Section Y952-9, Appliance and Merchandise Dept., General Electric Co., Bridgeport, Conn. All Deltabeston Asbestos, Glass and synthetic wires are sold by Graybar Electric Company, G-E Supply Corp. and other G-E Merchandise Distributors.

GENERAL ELECTRIC

BUY WAR BONDS AND KEEP THEM

Cable	Ft. at 25 kv.	Ft. at 18 kv.
400 M. cir. mil Belted*	43,400	42,700
400 M. cir. mil Type H	26,000	28,500
500 M. cir. mil Type N	16,800	18,300
3/0 Belted*	88,500	16,300

*One conductor vs. other two conductors and ground.

cuit which acts to open a short-circuiting oil switch thus inserting sufficient resistance in the transformer primary circuit to limit its output to 200 percent of rating.

With the apparatus operating at an output voltage of 25 kv. or 18 kv. the following lengths of 13.2-kv. three-conductor can be handled without overloading the test set.

•

Oral Tests in Lineman Training—IV*

C. T. MALLOY

General Superintendent
Transmission, Distribution and Communication
Southern California Edison Co., Ltd.,
Los Angeles

Prior to advancement as patrolman or first-class lineman for transmission line maintenance and operation, apprentice patrolmen and second-class linemen are given an oral examination. The following items have been selected from their questionnaire.

1. A. Why are transmission and communication circuits transposed?
   B. How do you install a "physical" transposition in a communication circuit?
   C. How do you install a No. 2 phantom transposition in a communication circuit?
2. A. In using live line tools: What must be guarded against?
   B. Name the routine procedure for care of live line tools.
   C. Is wire covering ever relied upon for safety?
3. A. What are the more important features of the job that must be explained to a groundman to enable him to understand the work to be done?
4. A. Describe the procedure to be followed in making a 220-kv. conductor splice.
5. A. When does a guy wire need an insulator breaker in it?
   B. What is the minimum height of telephone line across a railroad track?
6. A. How is time worked accounted for?
   B. Why are material maps made?
   C. How is material accounted for?
7. A. Where would you check first for trouble on a communication circuit where it is known that a lightning storm was in progress when the trouble occurred?
   B. What are the most common causes of transmission line trouble?
8. A. Name several locations on your patrol that have conditions that may be a source of trouble.
   B. Who is responsible that installations are in accord with Commission safety orders?

* Concluding a series of four articles which began in ELECTRICAL WORLD, August 18, 1945.

GRIP-FLEX 45

Builders and operators of overhead power lines will welcome the new Copperweld Grip-Flex 45 insulator tie—simple, inexpensive and easy to install. Enables every lineman to do a uniform tying job because it substitutes for uncertain care and skill the machine precision of a few factory preformed parts.

Copperweld Grip-Flex 45 is the ideal insulator tie for Copperweld and Copperweld-Copper Conductors, for both top and side tying. It provides a floating support for the conductor—the reinforcing wires keep the conductor away from the insulator. The binding wire does not touch the conductor. Strong holding power against unbalanced line tension is assured. *These ties fully meet the requirements of the National Electrical Safety Code.*

Copperweld Grip-Flex 45 is new—but not untried. Extensive tests in Copperweld's laboratory show this tie to be a distinct improvement over hand wrapped ties. It takes less time to apply—develops greater holding power—increases conductor life—and assures uniformly good results.

Write today for complete details.

Copperweld

Sold by

ANACONDA WIRE & CABLE COMPANY, NEW YORK, N. Y.
COPPERWELD STEEL COMPANY, GLASSPORT, PA.
KENNECOTT WIRE & CABLE COMPANY, PHILLIPSDALE (RUMFORD), R. I.
PHELPS DODGE COPPER PRODUCTS CORPORATION, NEW YORK, N. Y.

LOAD SERVICING

Commercial
Industrial

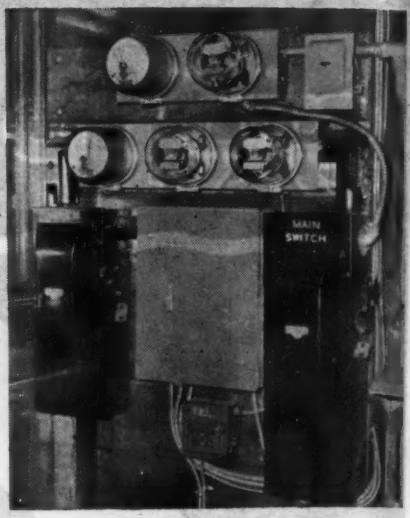
Residential
Rural

Railroad Station Lighting Load Appeals

Electric service to railroad stations has long been a comparatively uncultivated field from the standpoint of using modern facilities, and to the supplying utility this class of business possesses the attraction of good load factor, relatively long-hour use in numerous cases, and in general excellent power-factor. The Boston & Maine Railroad has recently redecorated its station at Lowell, Mass., and the project included the installation of 500-watt tungsten lamps mounted in prismatic luminaires for general waiting room service, with fluorescent units in the ticket offices and other auxiliary lighting, giving a total connected lighting load of about 20 kw. The intensity of illumination, while not high in relation to many recent industrial and office installations, measured about 12 foot-candles at the time the accompanying illustration was made, compared with about 3 foot-candles under either daylight or previous night lighting conditions. The quadrupling of this intensity suffices to put the present installation on a plane of greatly improved eye comfort, since it is now easy to read print while waiting for trains in the main station seating area. There are twelve 500-watt units in this room, mounted about 16 ft. above the floor level, the room being roughly 60 ft. square. Public acceptance of this improvement has been notable.

The lighting service in February, 1945 consumed 7,233 kw.-hr.; in March, 6,260; in April, 5,400; and May, about 4,370. Respective demands were 15, 14.5, 14 and 13 kw. With the older installation a year ago the monthly energy consumption ran from about 3,600 to 3,168 kw.-hr. The load-factor for February, 1945, was 71.8 percent; for March, 58 percent; for April 53.6 percent; and May, 45.2 percent. As there are no motors of consequence in the railway's section of the building, power factor is close to unity. Service is furnished by the Lowell Electric Light Corp., and the lighting installation also includes five 500-watt tungsten lamps housed in prismatic luminaires to illuminate a ladies' waiting room about 20 ft. by 27 ft., mounting heights being about 12 ft. above the floor. Four fluorescent units of two 40-watt tubes each light the ticket offices.

Separate demand and watt-hour meters are provided for the railway and a newsstand and lunch counter concession, and watt-hour meter for the New England Telephone facilities (booth lighting), with an independent switch for each user and a main switch with fuse cabinet for the total service, as shown.



ELECTRIC UTILITY SERVICES at Lowell railroad station are controlled and metered from a central point

BOSTON & MAINE'S IMPROVED LIGHTING of waiting room at Lowell, Mass., presages further development in worth-while field

Appliance Saturations in Chattanooga

W. G. DAVIES
Sales Manager
Chattanooga Electric Power Board
Chattanooga, Tenn.

High saturations of home electric appliances among customers of the Chattanooga Electric Power Board were disclosed by a recently completed survey of which the overall results are stated in the accompanying table. Check cards were mailed out with bills to all residential customers, 41,752 of them. Cards with ownership of appliances checked were returned by 24,234, 58 percent.

The table shows two columns of saturation percentages. The first assumes that non-reporting customers own appliances in the same ratios as those reporting. This assumption is not wholly tenable because the average use of energy by the reporting customers in the check month was higher than the average for all customers, indicating that appliance ownership was less among the non-report-

There is More Reason Today Than Ever Before to Specify Benjamin Lighting Units with *Porcelain Enamel Reflectors!*

The many important advancements made in all types of reflector finishes have left unchanged the 3 BIG REASONS for Porcelain Enamel's TOP RATING!

Advancements in porcelain enameling make possible lighting reflectors with even greater resistance to weather, chipping, acids, thermal shock, etc. However, while these advancements give added reason for its specification, basically the reasons for its TOP RATING remain the same. They are:

1. DURABILITY

TOP RATING in durability goes to porcelain enamel. Reason: porcelain enamel is an inorganic finish, being literally rock fused on steel. Hence, unlike organic finishes, porcelain enamel is *not subject* to oxidation and deterioration from the effects of time, heat, sunlight and atmospheric conditions.

2. REFLECTIVITY

TOP RATING, here, because with porcelain enamel you get a lighting unit which not only has a light diffusing reflection factor of 80% or more, but also one that will *retain* this efficiency for a *life-time*. For, although the better organic finishes now possess initial qualities of reflectivity the equal of porcelain enamel, only porcelain enamel has been so completely time tested. Years and years of service experience prove that porcelain enamel retains its light reflecting qualities throughout a life time of service without appreciable loss.

3. CLEANABILITY

TOP RATING goes to porcelain enamel. Because its dense, glass hard surface prevents dirt and oils from becoming embedded . . . because of its extreme resistance to scratches, marring, chipping . . . because it cannot oxidize or corrode . . . porcelain enamel surfaces are the most easily cleaned; require only soap and water washing.

ENAMEL SEALS AGAINST CORROSION

To be Sure you Get Reflectors Embodying the Latest Developments in Porcelain Enamel . . . Specify BENJAMIN LIFE-TIME PORCELAIN ENAMEL REFLECTORS . . . Years of pioneer leadership in the development of special light reflecting enamels and finer production methods employed in Benjamin's own porcelain enameling plant insures porcelain enamel of a uniform quality that is warranted to meet all recognized industry specifications including those of the RLM Standards Institute.

Remember: For Durability . . Reflectivity . . Cleanability . . *Specify*

BENJAMIN
TRADE MARK

LIFE-TIME PORCELAIN ENAMEL

Lighting Equipment

DISTRIBUTED EXCLUSIVELY THROUGH ELECTRICAL WHOLESALERS

BENJAMIN ELECTRIC MANUFACTURING COMPANY

DES PLAINES, ILLINOIS

1089

"Lights Out"— Blankets On

Used to be, your load-building day tapered way off when folks turned out the lights and went to sleep. But . . .

Now that G-E Automatic Blankets are being made again, lots of folks are going to be wanting these lightweight, "electrically-warm" blankets for *nightlong* sleeping comfort. (This means an additional nightlong load for you.)

For your information, two G-E Blankets equal one six-foot refrigerator in energy consumption!

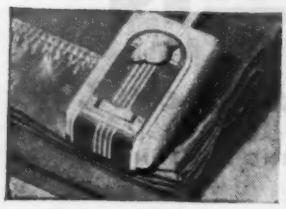
Many of your customers have been reading about G-E Blankets in the magazines—*Life, Good Housekeeping, House Beautiful, The Atlantic Monthly, Harper's, This Week.*

And hearing about them on the new, fact-packed radio show, "The G-E House Party."

That leaves the stage pretty well set for you to follow through in your community. Write to us for information and special material: General Electric Co., Appliance and Merchandise Dept., Bridgeport, Conn.

FOR GOOD LISTENING: *Don't miss Art Linkletter, in "The G-E House Party," every afternoon, Monday through Friday, 4 p. m., E. W. T., CBS. "The G-E All-Girl Orchestra," Sunday, 10 p. m., E. W. T., NBC. "The World Today," News, Monday through Friday, 6:45 p. m., E. W. T., CBS.*

"Everything Electrical for Homes After Victory"



Automatic Blanket

"Goes to work when the lights go out"

GENERAL ELECTRIC

ing group. Adjustment for this condition appears in the second column of saturation percentages. The adjustment ratio is 0.887, arrived at by dividing the average energy use for the month for all customers, 220 kw.-hr., by that for the reporting customers, 248 kw.-hr.

Appliance Saturations —Chattanooga

24,234 Reporting Customers out of 41,752 Total

	Number Reported	Percent Saturation Not Adjusted	Percent Saturation Adjusted
Refrigerators	17,948	74	66
Ranges	11,882	49	43.5
Water Heaters	5,889	24	21.3
Washers	10,526	43.5	38.6
Attic Fans	606	2.5	2.2
Stokers	3,137	13	11.5
Pumps	1,064	4.4	3.9
Irons	23,177	95	84.3

Reports were assembled in service districts, 25 in all, averaging 1,670 customers per district, 481 in the smallest and 2,218 in the largest. Returns from districts ranged from 36 to 72 percent. The lowest saturation per district for refrigerators was 23 percent and the highest 94; for ranges, lowest 8 percent and highest 82; for water heaters, 3 percent and 61; for irons 89 percent and 99.

Helps Customers Estimate Wiring

A. W. HARRIS
Supervisor, Dealer Coordination, Georgia Power Co., Atlanta, Ga.

To give prospective home builders and remodelers a clear picture of wiring necessary for satisfactory electric service, The Georgia Power Co. furnishes to customers forms on which, alone or assisted by a company representative, they can estimate their own wiring requirements.

The form, on three letter-size mimeographed sheets, follows quite closely the instructions and recommendations contained in "Electrical Guide to the Post-War Home" published by the Adequate Wiring Bureau.

First on the form is determination of size of service entrance, specified to be three-wire, based on floor area of the dwelling (calculated on outside dimensions and excluding open porches and unfinished basement and attic spaces) according to the following table:

Rewiring with Roeplastic

Roebling Thermoplastic Thin Wall Wire...for Larger Load Capacity, More Circuits, Reduced Voltage Drop...in *Existing Conduits*

WITH CONDUITS AT FULL CAPACITY, have you been choosing the lesser of two evils . . . taking the loss from inadequate wiring, rather than the cost of larger conduit installation?

Insufficient wiring is costly in lost power, excessive voltage drop, reduced efficiency, slower production. Check over those plans and see how wiring modernization can be accomplished without ripping out old conduits or raceways.

Roeplastic small diameter wire, replacing ordinary Type R in rewiring, permits use of *more* or *larger* conductors, and a greater area of conduit fill. Not only does the amount of copper pulled through increase, but also the permissible operating temperature. Load capacity increases as high as 300% may be had! The cost of rewiring can well be offset by the savings from increased output.

Add to these advantages the superior properties of the free-stripping, synthetic insulation: high resistance to oil, chemicals, moisture, flame. It has excellent tensile strength, and will pull through conduit easily and without abrasion. Standard colors permit easy circuit coding.

Roeplastic (600 volt—60° C) is furnished in solid conductor, size 14 to 8 A.W.G., and stranded, 14 to 6 . . . type T for dry locations, TW for wet locations. Quantities will shortly be available for non-priority users. Write for details, and our Building Wire Catalog . . . you'll find it full of helpful wiring tables.

ROEBLING WHOLESALERS, *always giving the best in service, can fill your needs in Roeplastic . . . and Roebling's other fine electrical wires and cables too.*

JOHN A. ROEBLING'S SONS COMPANY

TRENTON 2, NEW JERSEY

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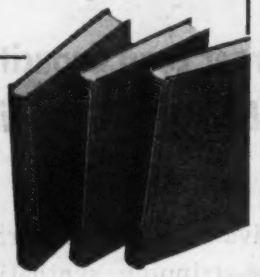
WEATHERPROOF WIRE • SERVICE ENTRANCE CABLES • RUBBER COVERED WIRES AND CABLES (INCLUDING THIN-WALL INSULATED BUILDING WIRES AND CABLES) • RUBBER INSULATED POWER CABLES • PIGTAIL AND BRAIDED COPPER • TELEPHONE WIRES • RUBBER SHEATHED PORTABLE CABLES • BARE COPPER STRAND • MAGNET WIRE • VARNISHED CAMBRIC POWER CABLES • TROLLEY CONTACT WIRE

PACEMAKER IN WIRE PRODUCTS

Take this direct route to job security and greater opportunity *in marine electricity*



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AS competition becomes each day more intense in your field, you will want the know-how in marine electricity that keeps you on the payroll, the added expertness that qualifies you for a better job as your plant reconverts to peace-time production. Now the Dodds' Library gives you a sound understanding of marine electrical fundamentals and applications, your first job-insurance and number one qualification for advancement and bigger pay.

MARINE ELECTRICIANS' LIBRARY

By J. M. Dodds

A THOROUGH reference handbook treatment of all phases of marine electrical work, with the exception of radio—electrical fundamentals and techniques, full details of installing, testing, repairing and maintenance. Numerous examples, formulas, tables, basic electrical principles and special problems on board ship and in the shipyard.

These books cover:

—essential principles of electricity and magnetism and characteristics of electrical circuits—machines and devices involved in distribution and generation of electrical power in shipyards and aboard ship.

—installing, adjusting and maintaining every sort of electrical equipment from relays and governors to switchboards, meters, and electrically-powered instruments.

—how to solve any electrical motor, crane, gear, lamp or other kind of electrical problem except radio which may occur on board ship.

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1,000 to 1,500	No. 4	60 amp.
1,500 to 3,000	No. 4	100 amp.
3,000 to 9,000	No. 2	100 amp.

Next comes number of circuits required for general use, stated as one circuit for each 500 sq. ft. of floor area and fraction thereof. Additional to these are 20-amp., 2,300-watt appliance circuits in dining room, kitchen and laundry, estimated on appliances expected to be used in these locations. To aid in estimating, the form includes a list of commonly used appliances with their approximate wattages. Individual circuits are stated to be necessary for large appliances—range, water heater, automatic washer, laundry drier, water pump, attic fan, air conditioner, etc. The form includes spaces for entries of these various circuits, plus two additional for future uses, so that they can be added up to give the total number required.

The third section of the form is concerned with determination of number of use and control outlets needed—fixed lighting and portable lamps, radios, clocks, switches—their locations and functions.

When filled out, the form is an effective specification of what the customer wants the wiring to be in his new or remodeled home and as such can be given to architect or contractor as a basis for cost estimate. The form is freely available at company offices, but is brought to customers' notice principally by home service representatives in personal calls.

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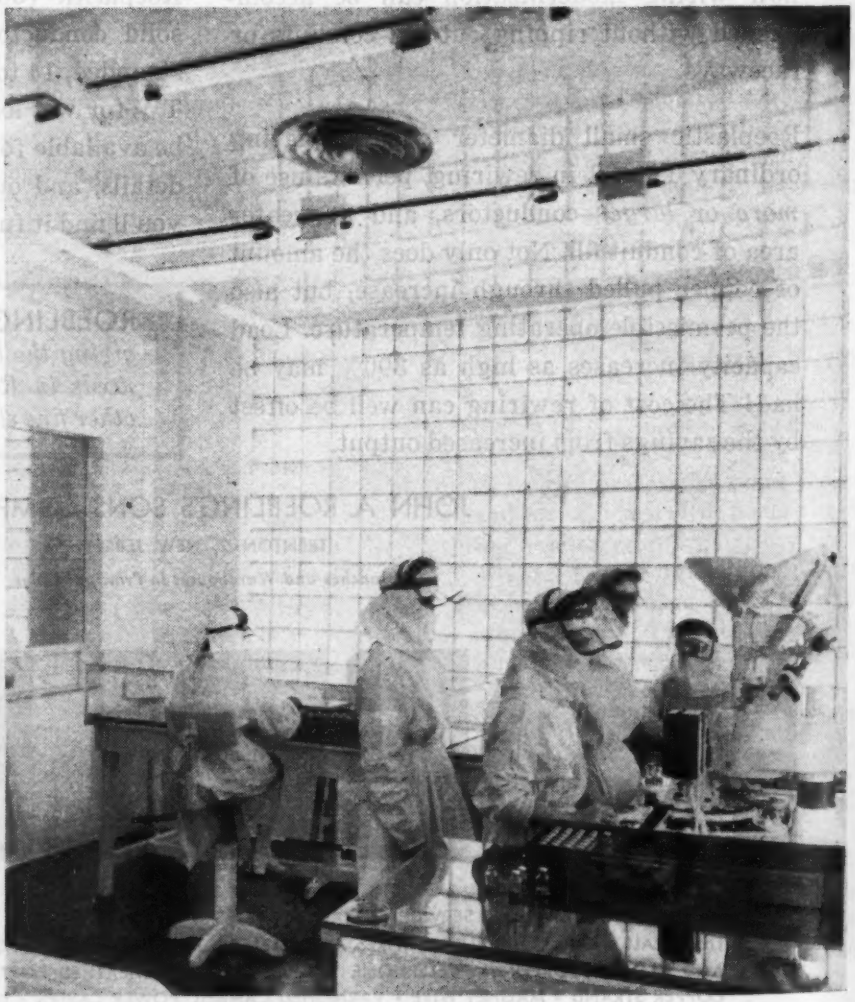
Sterilamps Protect Penicillin



AIR-BORNE BACTERIA that would contaminate the drug are killed by Sterilamps in many stages of the manufacture of penicillin. Here, workers in the Commercial Solvents Corp.'s plant at Terre Haute, Ind., are capping vials, their eyes protected from the ultraviolet rays by transparent masks

You can't pull it out of a hat!

Good air conditioning is *not* hokus-pokus! It can only be the result of *correctly engineered equipment* correctly applied!

From the beginning, Westinghouse has worked singularly on this one principle. For any installation, regardless of size or purpose, is only as *right* as the engineering behind the equipment that performs the magic of *correctly* conditioning the air.

By *correct* air conditioning Westinghouse means the scientific blending of desired temperature, humidity, circulation, ventilation and air cleanliness.

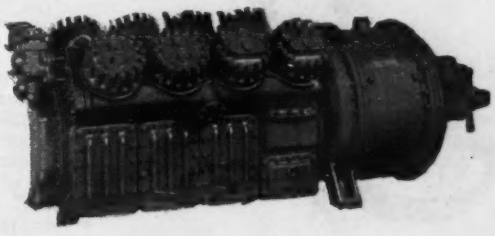
Consider these advantages: First, an air conditioning plant which will provide exactly the conditioned air you want to "live" with. Second, an installation which can be depended upon to give continued trouble-free and economical service. Third, correctly engineered equipment resulting from Westinghouse know-how.

If you're thinking about air conditioning, write for your copy of "How to Plan Correct Air Conditioning." Call your nearest Westinghouse Office, or write Westinghouse Electric Corporation, 150 Pacific Avenue, Jersey City 4, New Jersey.

CURRENT WESTINGHOUSE ADVERTISING IS DESIGNED TO SELL AIR CONDITIONING... AND INCREASED LOAD FOR YOU!

The Heart of Correct Air Conditioning

WESTINGHOUSE HERMETICALLY SEALED COMPRESSOR



The entire mechanism of the Westinghouse Hermetically Sealed Compressor—including its motor—is sealed gas-tight. This feature means sealed-in *power and* sealed-out *trouble . . . has been* service-proved *in thousands of Westinghouse installations. Compact and lightweight for easy installation. Low operating costs.*

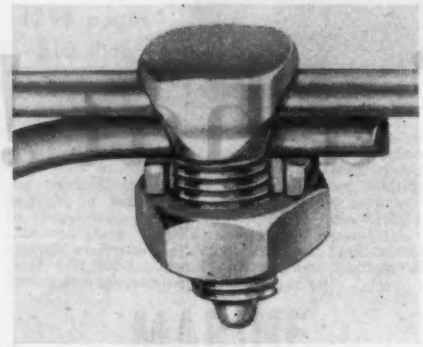
Westinghouse presents John Charles Thomas—Sunday, 2:30 E.W.T., N.B.C. Tune in Ted Malone, Monday through Friday, 11:45 A.M., E.W.T., Blue Network.

Westinghouse CORRECT Air Conditioning

PLANTS IN 25 CITIES OFFICES EVERYWHERE

NEW EQUIPMENT

Connectors



Type "F" forged bolt connectors: 5 sizes; for copper and Copperweld wires. **Reliable Electric Co.**, 3145 Carroll Ave., Chicago 12, Ill.

Forged bolt connectors are made in five sizes to accommodate AWG Nos. 9, 6, 4, 2, 1 solid; Nos. 10, 8, 6, 3, 2 strand; and 8A, 6A and 4A Copperweld. They are said to have the same efficiency as the machined type, and to have a higher copper content.

•

Telephone Equipment

Lineman's bridge: 111 ohms max.; battery powered; size 9 in. by 5 in., by 4½ in.; wt. 5 lb. **Nilsson Electrical Laboratory, Inc.**, 103 Lafayette St., New York 13, N. Y.

Bridge which is used to measure the resistance of wires and the unbalance between two wires is designed primarily for telephone work. The unit is designed so that the reading on the loop can be changed to the unbalanced reading without disturbing the connections by throwing a switch and changing the positions of the three decade dials. The switch position designates which wire is of the higher resistance. The range of measurement is up to 111 ohms in steps of one tenth of an ohm with a reported accuracy of one-quarter of one percent. The unit has a Weston Model 375 galvanometer and is powered by standard 1½- volt flashlight batteries.

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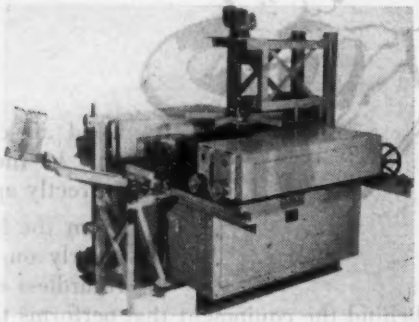
Furnace



Salt bath furnace: manually or automatically loaded: 500 lb. of steel fittings heated per hour. **Ajax Electric Co., Inc.**, Frankford Ave., Philadelphia 23, Pa.

Furnace automatically removes baskets containing small parts upon completion of the hardening heat treatment in the molten salt. A motor driven mechanism rotates the five heat-resisting alloy wire baskets through the liquid bath. Each remains in the furnace for an identical period of time and this may be adjusted by means of a controlling time switch.

•

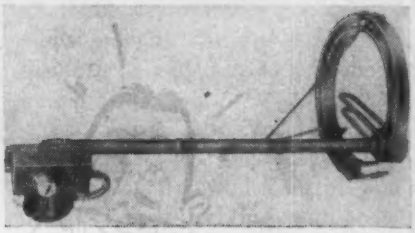
Cathode-Ray Tube

Type "5SP" double-beam cathode-ray tube; 5-in. envelope. **Allen B. DuMont Laboratories, Inc.**, 2 Main St., Passaic, N. J.

The tube provides two complete "guns" in a single glass envelope both aimed at or converging on the single screen. There is reported to be complete and independent control of the X, Y and Z axis functions of each beam. Shielding between "guns" and "plates" is said to minimize "cross-talk". Standard AN diheptal 12-pin base fits the standard socket and the electrode voltage ratings are similar to those of AN type 5CP1.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Immersion Heater



Chromalox type "BLC" portable drum-immersion heater: 115 or 230-volt; single-phase; ratings up to 4,400 watts. **Edwin L. Wiegand Co.**, 7513 Thomas Boulevard, Pittsburgh 8, Pa.

An electric immersion heater designed especially for melting solid oils, greases and similar compounds in standard 55-gal. drums and like containers by allowing the heater to melt its way down through the contents. Steel sheathed heating elements nearly encircle the center tubular unit. Unit is braced for rigidity; three-heat switch or thermostatic control available.

•

Lamps

Carbon filament type infra-red lamps: 128 to 500 watts; mechanical base. **North American Electric Lamp Co.**, 1014 Taylor St., St. Louis 6, Mo.

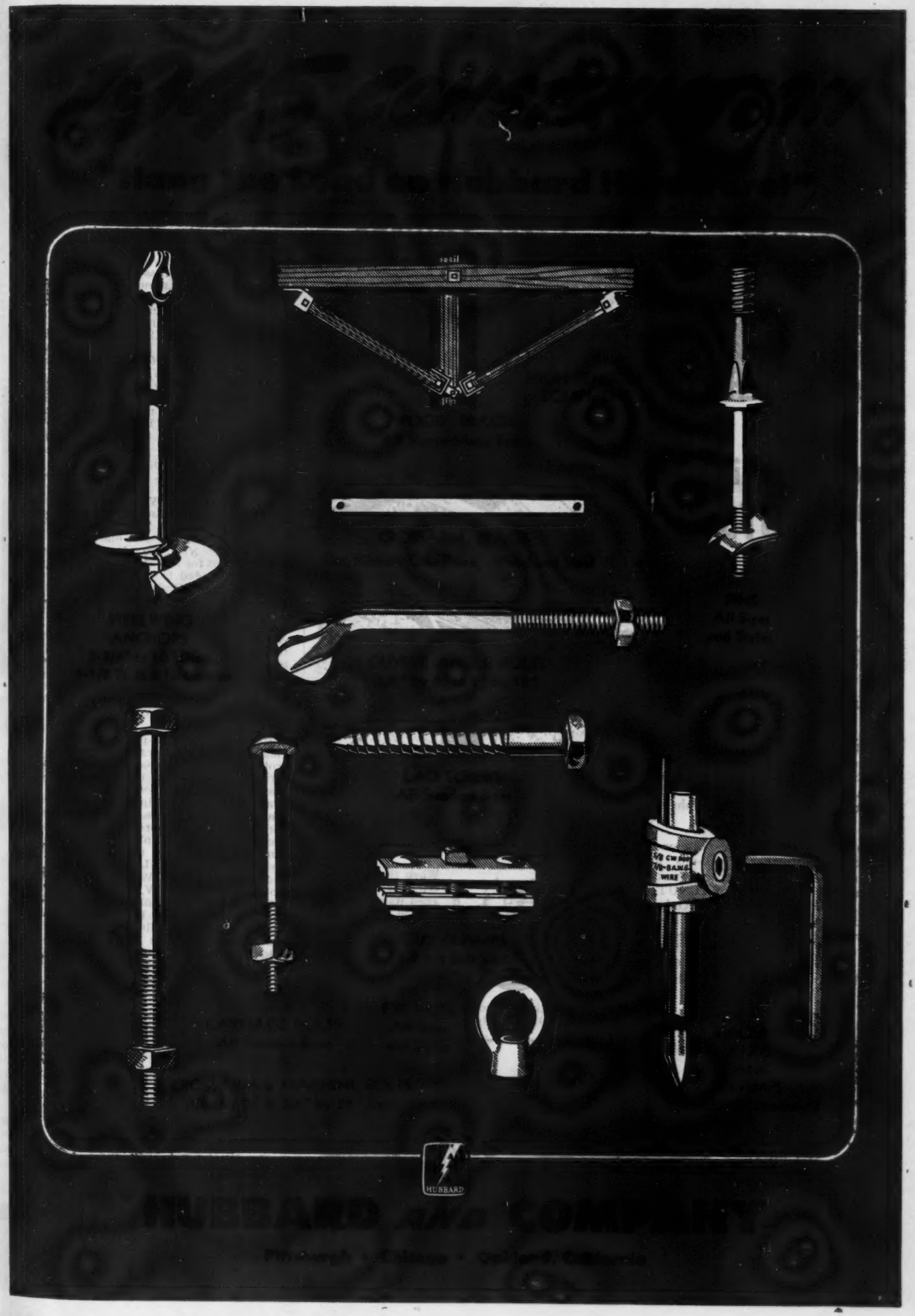
Lamps are made with a mechanical joint between the base and the bulb. This is said to eliminate the need for cements or other binders and to provide good lamp life characteristics under the heat of infra-red tunnel installations.

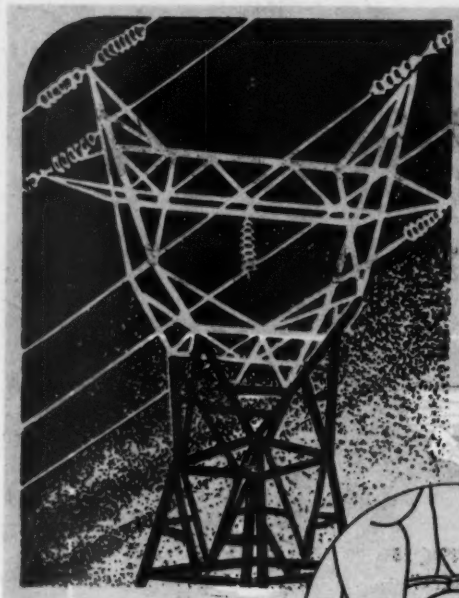
•

Pressure Transmitters

Model "PV" pressure transmitter: available in ranges from plus or minus ½ to plus or minus 50 p.s.i.; dimensions, 1¼ by 1¼ by 2½ in., weight, 3 oz. **Stathan Laboratories**, 8222 Beverly Blvd., Los Angeles 36, Cal.

The transmitters, which operate from batteries, are used as primary elements in indicating, and recording dynamic and static pressures of air or liquids. The sensitive element employs the unbonded strain filament technique; the bridge is connected and stated to be permanently balanced inside the instrument. Linearity, accuracy and permanence of calibration are stated to be within two percent. Unit can be obtained with two pressure inlets for differential pressure measurement, or with single pressure inlet for either vacuum or pressure reference.


HUBBARD



KEEP BOLTS TIGHT ON STEEL TOWERS AND WOOD POLE LINES

Add Double-Locking PALNUTS To New And Old Lines!

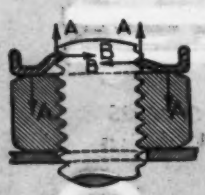
For over 10 years, Double Locking PALNUTS have been keeping bolt-and-nut assemblies tight on steel towers, wood pole lines, cross arms and braces, insulator pins, clevises and clamps.

PALNUTS are single thread locknuts made of tempered spring steel. They are easily, quickly spun on top of the regular nut, locked tight with 1/3 turn of the linesman's wrench. When locked PALNUTS exert a powerful double-locking action* on both nut and bolt, preventing loosening under vibration or shrinkage of parts.

When applied on new installations, PALNUTS save further check-ups and re-tightening. Maintenance crews checking old installations can add PALNUTS without disturbing regular nut. Only 3 bolt threads space are required. PALNUTS are very low in cost; may be removed and re-used. They are available in a full range of sizes, in Hot Dipped Galvanized or other finishes and materials used by the Utility industry.

Send details of your needs for samples. Write for Palnut Manual No. 1 and detailed folder on power line applications.

*** DOUBLE LOCKING ACTION**



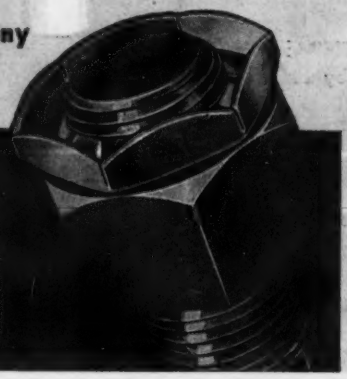
When the PALNUT is tightened, its arched, slotted jaws grip the bolt like a chuck (B-B), while spring tension is exerted upward on the bolt thread and downward on the nut (A-A), securely locking both.

The Palnut Company
51 Cordier Street
Irvington 11, N. J.

Used Today on Aircraft, Tanks, Jeeps, Military Vehicles and other War Equipment

DOUBLE-LOCKING

PALNUTS



TECHNICAL LITERATURE

Fire Fighting—A 32-page book, "How to Put Out a Motor Vehicle Fire," consists mainly of simple, concise instructions of what to do when a fire breaks out—how to handle ignition fires, gasoline fires, fires in the interior, under the hood, and under the vehicle itself. Simple rules to follow in the prevention of motor vehicle fires and complete I.C.C. safety regulations are also included. Present supply limits free copies to one per person. May be obtained from The General Detroit Corp., 2270 E. Jefferson Ave., Detroit 7, Mich.

Lubrication—"The Lubrication of Automotive Diesel Engines" is a 50-page book written for maintenance forces whose experience has been mainly with gasoline engines. Some of the chapter headings are: (1) Some Interesting Fundamentals of the Diesel Engine, (2) Lubricating Functions of the Oil, (4) Selection and Care of Lubricating Oils, (5) Tests Applied to Lubricating Oils, (6) Engine Tests, (7) Care of Lubricating Oils, (8) Fuels and Their Combustion and (9) Operation and Maintenance. Copies may be obtained from Gulf Oil Corp., Gulf Bldg., Pittsburgh, Pa.

Standards—Three recent standards obtainable from American Institute of Electrical Engineers, 33 West 39th St., New York City are: 1. Report on Aircraft D.C. Apparatus Voltage Ratings is A.I.E.E. No. 700 and was prepared by Committee on Air Transportation as a proposed standards for one year's trial. 2. A.I.E.E. No. 600 is Recommended Specification for Speed Governing of Prime Movers Intended to Drive Electric Generators. Scope is limited to steam turbines used in driving generators of not less than 10,000-kw. rated capacity. Report was prepared by joint A.I.E.E. and A.S.M.E. committee and is recommended for one year's trial use. 3. A.I.E.E. No. 25 is entitled Standards for Fuses Above 600 Volts and applies to all fuses, whether for indoor or outdoor service, except those for 600 volts and below. Standards are available at 40 cents per copy.

Governors—A 24-page bulletin (No. B6356) on the subject of centralized control provided by modern governors for large hydro-electric units is fully illustrated with governor and related hydraulic-turbine equipment photographs, diagrams and figures. It also defines the functions of governors and describes set-ups for Francis, Kaplan and Pelton turbines. Described in detail are arrangements at Pickwick Landing plant, Kentucky power plant, Wilson Dam, and the Fontana plant of T.V.A.; the Alcoa Glenville plant of Natahola Power and Light Co. and the Interior Departments' Shasta Power plant. Bulletin concludes with a four page discussion of "Governor Operation in Practice" and a "Comparison of Governor Characteristics." Copies may be secured from Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Alloys—Bulletin No. 158 describes a group of alloys which are merchandized under the name of Callinite. Among the applications described are facing tips on air circuit breakers, motor controllers, relays, industrial control contacts and other places where pitting, sticking or welding of contacts may occur. Copies may be obtained from Callite Tungsten Corp., 540 39th St., Union City, N. J.

Handbook—The "Handbook of Welded Steel Tubing" contains the physical, chemical and metallurgical properties of welded carbon and alloy steel tubing together with commercial tolerance limitations and extensive engineering data. It is written to serve as a guide to both engineers and laymen who are engaged in the application of welded steel tubing. Copies are available at $1.00 each from the Formed Steel Tube Institute, 1621 Euclid Ave., Cleveland, Ohio.

System expansion plan should include anchors to fit the conditions

When postwar plans for line extension finally begin to materialize, there will be Chance Anchors available to meet the most exacting specifications.

To insure the greatest protection for investments in new construction, to get the most efficient anchoring under all soil and guying conditions, plan to make anchor selections from this—the most complete line. Standardize wherever possible, of course, but bear in mind that one anchor just won't do the job as it should be done under all conditions. That's why Chance Anchors are made in so many types and sizes. That's why it pays to specify Chance Anchors in order to meet any and all requirements.

Here are a few of the most prominent types. There are several others and many sizes. Where soil and guying conditions are known factors, definite anchor selections can be written into your specifications now. Your Chance catalog of Pole Line Equipment, the Chance Guy Calculators (available on request) will help you in making these selections. If possible, plan ahead and place your order for future delivery. If your need is immediate, perhaps the anchors can be supplied by your Electrical Jobber now.

Although our production of these anchors for the Signal Corps has been curtailed, the heavy backlog of orders from Public Utilities has most of our production output booked up for several months. With the war job done, however, we should soon be able to supply the anchors for your postwar construction.

BUILD SECURITY INTO YOUR LINES

A·B·CHANCE CO·
CENTRALIA, MISSOURI.

Here's one practical suggestion on how G-E lamps, with proper equipment and maintenance, can help guard lives at night. Modern safety traffic lighting, Alameda, Calif. Plan for it in your territory... good street lighting builds good will.
. . . Good lamps are the heart of good street lighting
2,500 LUMEN
15,000 LUMEN
TRAFFIC SIGNAL
G-E offers
5 big advantages!
1. All the latest developments of G-E Lamp Research.
2. Lower and lower prices—50% less over last ten years.
3. G-E field engineers to work with you—help you give the public better seeing per dollar spent on street lighting.
4. More than 480 tests to assure high quality in G-E lamps.
5. Complete line readily available through nationwide G-E stocks.
THE AIM OF G-E LAMP RESEARCH IS ALWAYS
TO MAKE G-E LAMPS Stay Brighter Longer
G-E LAMPS
GENERAL ELECTRIC

NEWS ABOUT PEOPLE

Florida Utility Elects R. H. Fite Vice-President

Robert H. Fite, who has been head of the Washington (D. C.) office of Ebasco Services, Inc., since 1941, has been named vice-president and a director of the Florida Power & Light Co., Miami. In assuming his new executive duties, Mr. Fite is returning to the company he served for many years.

R. H. Fite

His first association with the Miami utility was in 1926 as an engineer. He transferred almost immediately thereafter to the rate department and later became head of that department. In 1932 he was appointed general sales manager. He left Florida Power & Light Co. in 1936 to enter the sales department of Ebasco Services, Inc., in New York and three years later he became head of Ebasco's sales department. He then went to Washington.

A graduate of Vanderbilt University, Mr. Fite joined General Electric Co. at Schenectady, where he spent one year, the following year going to Nashville for G.E.

•

▶ P. D. FAHNESTOCK has been appointed director of information for the Committee for Economic Development. Mr. Fahnestock, who has been acting director of information for CED for the past four months, succeeds ANTHONY HYDE, who is now in charge of public relations for the Office of War Mobilization and Reconversion in Washington.

▶ CURTIS E. CALDER, chairman of the board of Electric Bond & Share Co., has been elected a director of the Lehman Corp. Before becoming chairman of Electric Bond & Share last year, Mr. Calder had been president of American & Foreign Power Co., Inc., since 1927.

▶ WILBUR K. MILLER, attorney of Owensboro, and former chairman of the Kentucky Public Service Commission, has been appointed an associate justice of the U. S. Court of Appeals at Washington, D. C., by President Truman.

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New Appointments Made by Detroit Edison Co.

Changes in the Detroit office staff of the Detroit Edison Co. sales department have been announced by Angus D. McLay, vice-president and sales manager.

Charles C. Munroe, formerly superintendent of lighting sales, has been transferred to the staff of the sales manager, specializing in research and studies of the new forms of lighting sources and their application.

Lee E. Tayler, formerly assistant to the superintendent of lighting sales, has become senior engineer of lighting sales. Paul L. Penfield, assistant to the sales manager, will be responsible for the company's advertising and for the company magazine "Synchroscope."

Thomas F. Gessner, formerly advertising manager, has resigned to join the public relations staff of the Evans Products Co.

Harold J. Hall, formerly staff engineer, has been appointed district commercial manager at Birmingham, which includes the southern section of Oakland County, succeeding Ralph W. Bricker, transferred to the Monroe office. The retirement, after 34 years of service, of William J. Fitzgerald, for 26 years district commercial manager at Monroe was also announced.

Freeman Named President of Middle West Corp.

Announcement has been made of the election of William C. Freeman to the presidency of the Middle West Corp. Mr. Freeman was also elected a member of the company's board of directors.

W. C. Freeman

In the office of president he is succeeding Purcell L. Smith, who recently resigned to become president of the National Association of Electric Companies.

Prior to his association with Middle West, Mr. Freeman was a commercial banker, having been vice-president of National Bank of Republic and executive vice-president of National Republic Co., investment affiliate of the bank. for a number of years.

Mr. Freeman was born in Freemansburgh, Pa., March 9, 1887 and entered the banking business in Chicago at the age of 15 with the National Bank of which he subsequently became vice-president.

In addition to his connection with Middle West Corp., Mr. Freeman is a director of American Service Co., Kansas City, Mo.; Ashland Oil & Refining Co., Ashland, Ky.; Indiana Gas & Water Co., Inc., Indianapolis; Mid-Continent Laundries, Inc., Chicago; Public Service Co. of Indiana, Inc., Indianapolis and Yates-American Machine Co., Beloit, Wisconsin.

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▶ ALBERT L. MAILLARD has been appointed managing director of the Electric League of Indianapolis, Inc. Mr. Maillard was named to succeed Walter O. Zervas, who left last June to take an executive position with the American Iron and Steel Institute in New York, after serving five years with the Indianapolis league. Mr. Maillard was formerly in charge of electric facilities of the Jayhawk ordnance works at Pitts-

burg, Kans. Previously he was connected with the Kansas City Power & Light Co. for 13 years. Mr. Maillard is a member of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the American Society of Heating and Ventilating Engineers.

▶ THOMAS HAYWOOD has been elected manager of the Inter-County Rural Electric Co-operative at Hillsboro, Ohio.

•

Northern States Power Announces Promotions

Announcement has been made by the Northern States Power Co. of the appointment of S. H. Conkey as general sales manager and of Lt. Colonel Carl T. Bremicker as assistant general sales manager. Robert E. Steele has been

S. H. Conkey

named manager of the lighting sales department and Byron W. Hanson sales manager of the Fargo division of the company.

Mr. Conkey was formerly assistant general sales manager and Colonel Bremicker succeeds to the assistant general sales manager's position as a result of Mr. Conkey's promotion.

Formerly manager of the company's lighting sales department, Colonel Bremicker has recently returned from over seas duty with the Army Air Corps. New manager of the lighting sales department, Mr. Steele has been with the company as industrial lighting engineer for 21 years and long has been an active figure in Northwest industrial and civic affairs.

Mr. Hanson was formerly a member of the company's dealer promotion department and for the past three years has been with the War Production Board.

Canadian Utility Assigns New Duties to Little

J. J. Little, general manager of the Northern British Columbia Power Co., Limited, Prince Rupert, B. C., has been

J. J. Little

appointed to hold the additional position of vice-president.

A native of Edinburgh, Scotland, Mr. Little, after his arrival in Canada in 1909, worked on various construction jobs, engaging in electrical work on the first plant installed in Prince Rupert for the City Municipal Public Utilities. Following military service in World War I, he returned to City Utilities. He served as superintendent of the light and telephone departments until 1929, when the municipal undertaking was purchased by the Power Corp. of Canada.

When the local company was formed under the name of Northern British Columbia Power Co., Ltd., Mr. Little was appointed general manager of the company and its subsidiaries, the position he held until his recent promotion.

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▶ JAMES F. REILLY, former member of the District of Columbia Public Utilities Commission and formerly associated with the Civil Aeronautics Board, has been named counsel for United Air Lines at Washington, D. C.

▶ P. T. LAGRONE, division manager for the Mississippi Power & Light Co., at Greenville, Miss., since 1939, and an official of the company since 1926, has resigned to enter the electrical appliance business at Greenville. C. M. BROUGH has been appointed by the utility company to succeed Mr. Lagrone.

▶ JOHN JOHNS, sales department, Oklahoma Gas & Electric Co., has been named rural consultant of the company, succeeding Roy E. Hayman, resigned. Mr. Johns joined the Oklahoma Gas organization in 1937 as a rural solicitor in what was then the commercial department. In 1941 he was transferred to Oklahoma City as rural representative in the sales department.

•

Livingston Opens Sales, Engineering Offices

J. M. Livingston, well-known in the electric utility field for many years, has resigned as sales manager of Schweitzer & Conrad, Inc., Chicago, effective September 15, to open his own electrical sales-engineering office in Chicago. His successor has not been announced.

Mr. Livingston began his electrical industry career with the Westinghouse Electric Corp. in 1914, leaving to serve overseas during World War I. After the war, in 1919, he returned to the

J. M. Livingston

electrical industry as assistant sales manager and later sales manager of Electric Power Equipment Co., Philadelphia, where he remained until joining Schweitzer & Conrad, Inc., as sales manager in 1929.

Mr. Livingston will represent Schweitzer & Conrad, G & W Electric Specialty Co. and Standard Transformer Co. of Ohio.

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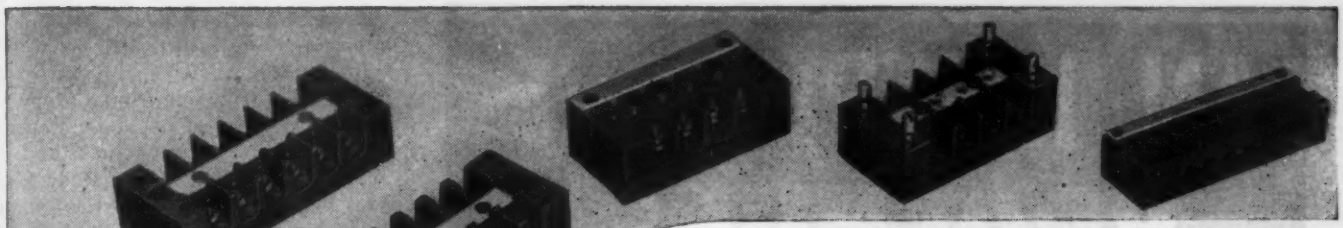
▶ DR. JAMES CREESE, vice-president of Stevens Institute of Technology since 1928, has been elected president of Drexel Institute of Technology in Philadelphia. He will assume his new duties on October 1. In 1940 Dr. Creese directed a survey of the need of technically trained men for war industries in the New York industrial area under the auspices of the New York Committee on Engineering Training for National Defense and the American Association for Adult Education. During his association



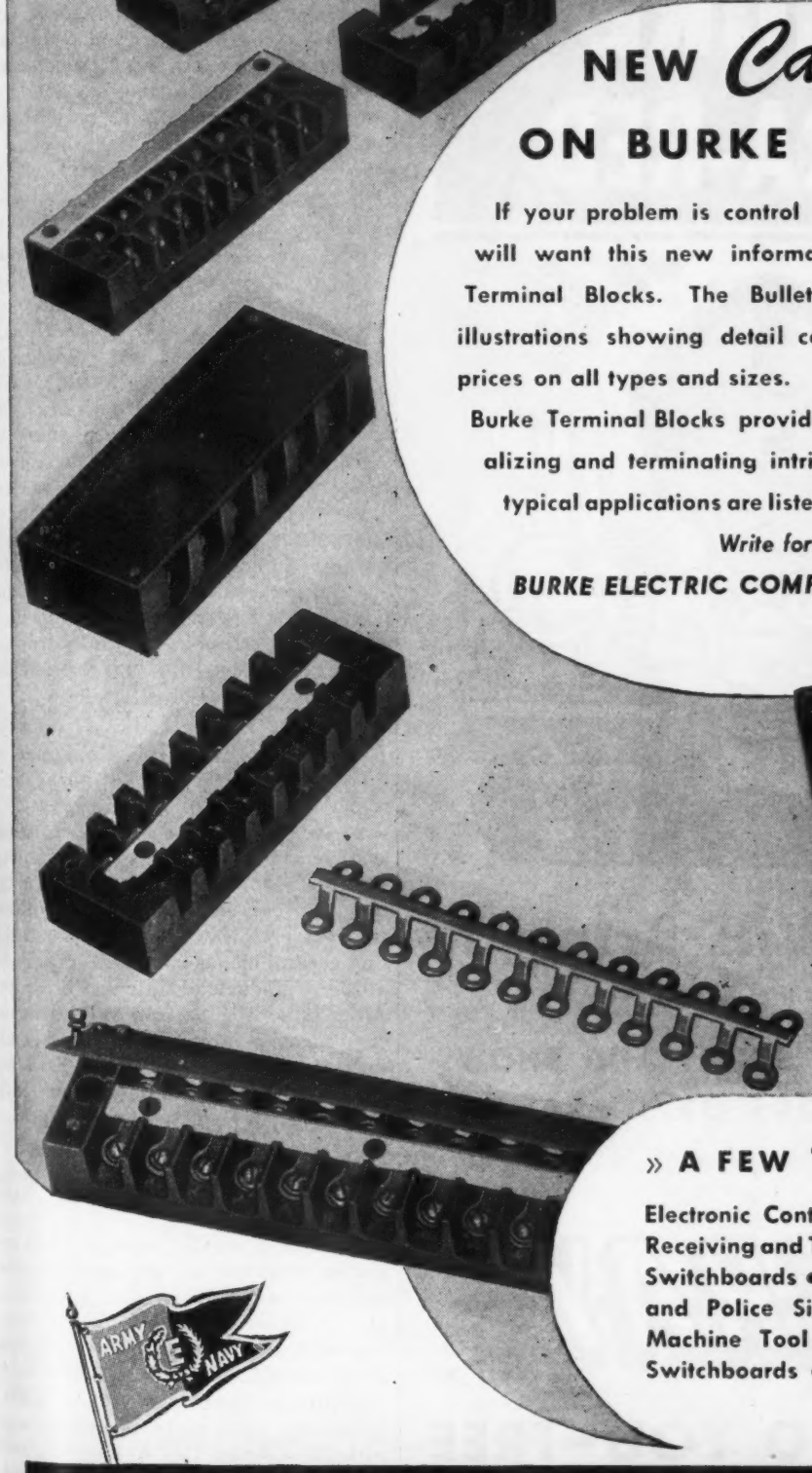
NEW *Catalog* AVAILABLE ON BURKE TERMINAL BLOCKS

If your problem is control circuit design, layout, or installation, you will want this new informative bulletin on Burke Molded Bakelite Terminal Blocks. The Bulletin contains actual size cross sectional illustrations showing detail construction features, with dimension and prices on all types and sizes.

Burke Terminal Blocks provide a simple method of identifying, sectionalizing and terminating intricate control circuit wiring—a few of the typical applications are listed below. Prompt deliveries are being made.

Write for your copy of booklet TB-3

BURKE ELECTRIC COMPANY • 155 W. 12th STREET • ERIE, PA.



» A FEW *Typical* USES

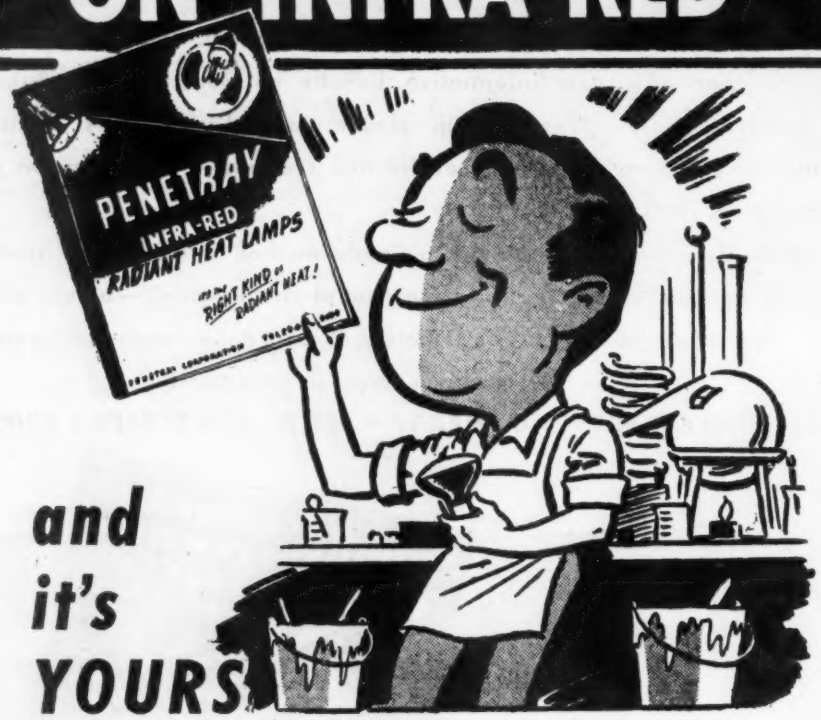
Electronic Control Systems • Radar Equipment • Radio Receiving and Transmitting Sets • Telephone and Telegraph Switchboards • Load Dispatching Signal Systems • Fire and Police Signal Systems • Traffic Signal Systems Machine Tool Control • Voltage Regulator Equipment Switchboards of all kinds • Automatic Welding Control Induction Heating Control

MOTORS 1 TO 1500 H. P. • GENERATORS 1 TO 1000 K. W.

BURKE A.C. & D.C. Motors & Generators

BURKE ELECTRIC COMPANY, ERIE, PENNSYLVANIA • *Since 1891*

AN INSTRUCTIVE BROCHURE ON INFRA-RED



and it's YOURS

A Post Card Will Bring It

•

IT TELLS THE COMPLETE STORY AND SHOWS BEAUTIFUL INSTALLATIONS OF INFRA-RED

•

PENETRAY

TRADE MARK

WILL SEND IT TO YOU—FREE

PENETRAY CORPORATION
TOLEDO 5, OHIO

with the American Scandinavian Foundation, which preceded his connection with Stevens, he helped initiate a system of industrial fellowships providing for the exchange of about forty men a year between the United States and the Scandinavian countries for study, work and experience in industrial plants, supplementing the interchange of students between American and Scandinavian universities. At Stevens among his special interests was the expansion of work in the humanities as part of the engineering curriculum.

▶ W. E. Dueringer has been appointed assistant sales manager and H. E. Weaver proposition department manager of the Bailey Meter Co., Cleveland. Both Mr. Dueringer, who is a graduate of the University of Illinois and Mr. Weaver, who is a graduate of Johns Hopkins University, have been associated with the Bailey Meter organization for more than 25 years in various engineering and sales capacities. As assistant to H. M. Hammond, general sales manager, Mr. Dueringer supervises activities of the company's proposition and order departments. Mr. Weaver, as proposition department manager, heads a staff of industry specialists, each of whom has carefully studied the measurement and control problems of a group of related industries.

▶ Max J. L. Schulte has resigned as vice-president, secretary-treasurer and general manager of the Rawlplug Co., Inc., New York, after 21 years of association with that organization. Joining the Rawlplug Co. in 1924 as sales manager, he took on added responsibilities as vice-president, secretary-treasurer and general manager of the company in 1930. A graduate of Cornell University, Mr. Schulte from the time of his graduation engaged in engineering and engineering sales in power plant and related fields until his association with Rawlplug.

OBITUARY

▶ Paul D. Birdsall, secretary and assistant treasurer of the newly-formed Indiana Gas & Water Co., Inc., died at his home in Indianapolis on September 5 after a brief illness. He was 55 years old. Mr. Birdsall had held executive positions with various utility companies. His early experience was with the Elkhart Gas & Fuel Co. and the Merchants Heat & Light Co. and in succeeding years he served as purchasing agent, secretary and assistant treasurer of the Central Indiana Power Co. and subsidiaries; assistant treasurer and manager of the tax department of Utilities Service, Inc., where he

NEW!

FARGO

HOT LINE CLAMP PREVENTS TROUBLES DUE TO LOOSE CONTACT ARCING

BUILT FOR EITHER HOOK OR SOCKET HOT STICK
COMPLETE HOUSING AND LUBRICATION OF THREAD PREVENTS CORROSION
FREE SLIDING VISE-TYPE SLEEVE MOVES WITH SPRING
ROUNDED EDGES
V-GROOVE JAW CONSTRUCTION ASSURES 4-POINT CONTACT
HEAVY COIL SPRING AUTOMATICALLY TAKES UP ANY VARIATION IN DIAMETER OF CONDUCTOR
BUILT FOR EITHER HOOK OR SOCKET HOT STICK

A.G.E.1 Fargo vise-type hot line clamp with sure-grip spring. (Spring made of vanadium steel, stress-relief annealed after plating to insure permanent spring strength.)

SPRING CLAMP: The new A.G.E.-1 Fargo all-purpose hot line clamp *stays tightly clamped.* Because of the vise-type Fargo body, the *heavy coil spring* at the base automatically takes up any variation in the diameter of the conductor. The spring exerts upward pressure on the lower jaw, and at the same time forces the *free sliding vise-type sleeve* of the upper jaw to clamp down further from above. In this way, any differential between the expansion and contraction coefficients of the clamp and the conductor caused by temperature changes, vibration, or the flowing of the conductor metals, is completely equalized by the joint action of the sliding sleeve and the heavy coil spring. With firm contact thus assured, troubles such as arcing are forestalled before they have a chance to occur.

SPRING STRENGTH: The heavy coil spring is made of vanadium steel, stress-relief annealed after plating, to insure permanent spring strength and resilience.

BALANCE: The clamp is designed so that it *will not topple* from the line while being installed with any type of hot stick.

PROTECTED THREAD: The complete housing of the bolt thread in a casing filled with No-Ox-Id anti-corrosion lubricant, assures easy turning at all times, prevents freezing and increases salvage value.

GOOD CONTACT: The *V-Groove jaw* construction of the clamp guarantees four points of contact on the conductor.

SMOOTH: *Rounded jaw edges* guard against marring the conductor; minimize arcing caused by sharp corners.

STANDARD STICK: The clamp is built so that any standard hot stick can be used for installation.

	Type Connection		Main Line Wire Size		Tap Wire Size		Net Prices*				
Catalog No.	Main Line Wire	Tap Wire	Maximum	Minimum	Maximum	Minimum	1–9	10-49	50-99	100 & over	Net Wt. Per Clamp
AGE-1 ALL-PURPOSE (Plated Bronze)	Aluminum	Aluminum	#2 ACSR+Armor #1/0 All Aluminum #4/0 ACSR	#6 ACSR #4 B&S All Aluminum	#1 ACSR #1/0 B&S All Aluminum	#6 ACSR #4 B&S All Aluminum	$1.50	$1.40	$1.25	$1.10	1 lb.
AGE-1	Aluminum	Copper	#2 ACSR+Armor #1/0 All Aluminum #4/0 ACSR	#6 ACSR #4 B&S All Aluminum	#7/0 Str. Copper #2/0 Sol. Copper	#6 Sol. Copper	1.50	1.40	1.25	1.10	1 lb.
AGE-1	Copper	Aluminum	250,000 C.M.	#6 Sol. Copper	#1 ACSR #1/0 B&S All Aluminum	#6 ACSR #4 B&S All Aluminum	1.50	1.40	1.25	1.10	1 lb.
AGE-1	Copper	Copper	250,000 C.M.	#6 Sol. Copper	#1/0 Str. Copper #2/0 Sol. Copper	#6 Sol. Copper	1.50	1.40	1.25	1.10	1 lb.
AGE-1A Cast Aluminum	Aluminum	Aluminum	#2 ACSR+Armor #1/0 All Aluminum #4/0 ACSR	#6 ACSR #4 B&S All Aluminum	#1 ACSR #1/0 B&S All Aluminum	#6 ACSR #4 B&S All Aluminum	1.60	1.50	1.35	1.20	.5 oz.
AGE-1C Cast Bronze	Copper	Copper	250,000 C.M.	#6 Sol. Copper	#1/0 Str. Copper #2/0 Sol. Copper	#6 Sol. Copper	1.45	1.35	1.20	1.05	1 lb.

NOTE: All Aluminum conductor sizes listed are B&S Gauge

*Net Prices are F.O.B. point of shipment, freight allowed to destination anywhere in the U.S.A.

Complete FARGO LINE (Solderless Connectors, Automatic Line Splices, etc.) *distributed by*

LINE MATERIAL COMPANY, *Milwaukee, Wisconsin*

(Representatives in principal cities)

FARGO MFG. COMPANY ESTABLISHED 1914 POUGHKEEPSIE, N. Y.

Royal-ettes

#21 in a series of informative letters from a producer of Power Switching Equipment.

ROYAL BUILDS SPECIAL CONTROL PANELS

● This 440-volt, 600-ampere panel unit was furnished to a large steel corporation for feeding and metering power to a group of grinders and tumbling mills.

A Royal three-pole, single-throw, type RR disconnect switch is mechanically interlocked with an ITE breaker. The circuit breaker may be operated with the disconnect switch completely open or closed.

The breaker will be tripped by either an opening or closing movement of the disconnect switch.

The panel is a 3-phase, 3-wire system operating from two current and two potential transformers furnished as part of the unit. A voltmeter, ammeter, watthour meter, and test switches are also part of the job.

We'll be glad to work with you on special problems like this.

ROYAL ELECTRIC MFG. CO. 619 E. 40th Street CHICAGO 15, ILL.

COFFING'S "Super-Man" SAYS:

"I may be a funny looking guy, but I'm proud of my physique. My head is spurred for efficiency. My body is electrified with strength and energy. My arms and legs are powerful and untiring and can do all your lifting and pulling jobs with an ease that is astounding. Right now I'm working for Uncle Sam, but I'll soon be free to work for you. Ask my boss about the thousand-and-one jobs I can do for you and what a help I'll be in the post-war period."

Our new folder describes Coffing Products that will be available for your peace-time needs.

WRITE FOR FOLDER NO. E 4

COFFING HOIST COMPANY

RATCHET LEVER HOISTS - SPUR GEAR HOISTS - ELECTRIC HOISTS
LOAD BINDERS - DIFFERENTIAL HOISTS - TROLLEYS

DANVILLE, ILLINOIS

continued through changes of companies to the Indiana Electric Corp and Public Service Co. of Indiana. In 1937 Mr. Birdsall became secretary-treasurer of Northern Indiana Power Co. and later supervisor, real estate taxes, of the Public Service Co. of Indiana.

▶ HARRY C. FRANK, research engineer, high-tension laboratories, General Cable Corp., Bayonne, N. J., died on June 9. A native of Newark, N. J., Mr. Frank was engaged as a laboratory assistant with the Weston Electrical Instrument Co., Newark, in 1908. Subsequent connections followed with the New York Edison Co. and the New York Public Service Commission and in 1920 he joined the teaching staff of the Stevens Institute of Technology. Entering the industrial field again, Mr. Frank in 1939 became associated with General Cable Corp., engaging in research on high-voltage power cables in the company's research laboratory. Mr. Frank was a member of the American Institute of Electrical Engineers, the American Physical Society and the Society for the Promotion of Engineering Education.

▶ F. A. CAMBRIDGE, formerly on the staff of the Western Canada Underwriters Association, Winnipeg, died on June 17 after a brief illness. Mr. Cambridge took a keen interest in the formulation of the Canadian Electrical Code, serving as a member of the special subcommittee that, in 1920, made its first report to the Canadian Standards Association main committee, recommending that a Canadian Electrical Code, suitable for national adoption he developed through the Canadian Engineering Standards Association. He was widely recognized for his efforts throughout the years of work on four published editions of the Code as well as in the current revision in the preparation of the proposed Fifth Edition. At the time of his death he was a member of a number of CSA committees.

▶ GEORGE E. GOODWIN, formerly resident engineer at Bonneville Dam and for several years in the Portland office of the United States Army Engineer, died on September 16 at Santa Cruz in his seventy-first year. A native of Gorham, N. H., and a graduate of the University of Maine, Mr. Goodwin engaged in construction work for a number of years before assuming the duties of resident engineer at Bonneville.

▶ WILLIAM K. HOLLAND, advertising manager for the Union Electric Co. of Missouri, died of a heart attack on September 11 at his home in St. Louis. He was 43 years of age. After an association with the American Telephone &

EARLY IN 1945, Mississippi Power & Light Company offered its assistance to the State Extension Service in further promoting 4-H Electric Clubs. The Extension Service, together with company officials, explained this new program to enthusiastic groups of Extension field representatives and company personnel in a series of regional meetings.

4-H'ER J. J. HERRING is already planning to substitute electric heat for kerosene oil, for brooding his chicks. (Left) J. J. Powell of Mississippi Power and Light Company.

4-H'ER WILEY AINSWORTH gets expert advice on wiring from Gayle Williams, Mississippi Power & Light Representative and Assistant County Agent Jack A. Warren, Jr. Wiley and his sister, Mary, are both active in 4-H Electric Club work and the Better Methods Electric Contest.

4-H'ER BILLY MAGEE, who is planning to *completely electrify* his farm, talks over his pumping problems with Mississippi State College representatives, L. O. Palmer and R. K. Smith. Billy is enthusiastic about the 4-H Electric Club and the Better Methods Electric Contest.

"4-H'ers learn to use more electricity...more effectively"

Mississippi Power and Light Company offers 92 Free Trips to State 4-H Club Round Up . . . to winners of 4-H Better Methods Electric Contest

To promote better living and greater efficiency on the farm through the proper use of electricity, Mississippi Power and Light, in cooperation with the Mississippi State Extension Service, is actively sponsoring a broad 4-H Electric Program, which ties in with the Better Methods Electric Contest.

Next November, 92 Mississippi 4-H boys and girls... who have done the most outstanding 4-H Electric Club work... will enjoy *free trips* to the State 4-H Club Round Up—as guests of the Mississippi Power and Light Company.

"These 4-H Electric Clubs help farm boys and girls learn to use *more* electricity . . . *more* effectively," says J. J. Powell, Residential and Advertising Manager of Mississippi Power and Light.

You, too, can sponsor a local 4-H Better Methods Electric Contest of your own—to help your load-building program. Send for "Here's Help to Increase Your Farm Load" which gives complete information regarding the Better Methods Contest, including free promotional material.

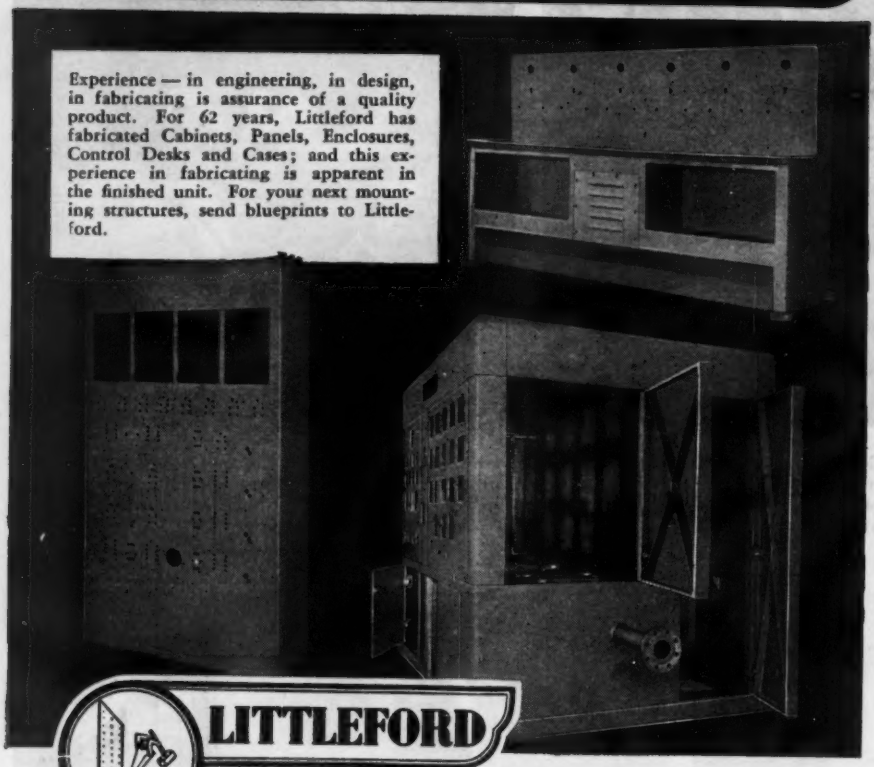
Contact your nearest Westinghouse office, today—or write: Rural Electrification Section (EW-115), Public Relations Department, Westinghouse Electric Corporation, Pittsburgh 30, Pa.

Westinghouse

PLANTS IN 25 CITIES OFFICES EVERYWHERE

Tune in: JOHN CHARLES THOMAS — Sunday, 2:30 pm, EWT, NBC • TED MALONE — Monday through Friday, 11:45 am, EWT, American Network

INSTRUMENT MOUNTING STRUCTURES



Experience — in engineering, in design, in fabricating is assurance of a quality product. For 62 years, Littleford has fabricated Cabinets, Panels, Enclosures, Control Desks and Cases; and this experience in fabricating is apparent in the finished unit. For your next mounting structures, send blueprints to Littleford.

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LITTLEFORD BROS., INC.
421 E. Pearl St., Cincinnati 2, Ohio

GET THE FACTS

WITH THE

McGRAW CENTRAL STATION DIRECTORY

This latest coverage of wartime changes in electric utility operations and personnel is published for those who work in or sell to the electrical utility industry.

THE McGraw Central Station Directory lists every discoverable change in the electric utility industry during the past 12 months. Changes in personnel and operations, areas served, generation and distribution equipment, are included for 4,000 utility plants in the U.S., Canada and U.S. possessions.

FACTS PRESENTED

1. Names and addresses of electric utilities in the U.S., Canada, and U.S. possessions; also government projects.

2. Names and addresses of affiliated, holding, controlling or managing and service companies with names and addresses of principal officials.

3. Names and addresses of officials and chief operating men for all operating companies.

REA CO-OPS LISTED

754 REA co-operatives are listed separately in the back of the Directory. This list includes new co-operatives formed during the past year.

USE BY UTILITIES

The directory is used by utility executives who wish to know about:

1. The organization of other utilities, especially those in their own or adjoining areas.

2. Movements of officials from company to company.

3. Discernible trends in expansions of operations of other utilities.

USE BY MANUFACTURERS

Manufacturers of electrical equipment and manufacturers of general equipment and supplies, all serving the utility industry, make use of the directory for

1. Names and addresses of executive, supervising, managing and engineering officials.

2. Determining electrical characteristics of plant, equipment and lines now in use.

3. Knowledge of scope of operations: generating capacity, towns and number of meters served, etc.

ORDER YOUR COPY TODAY!

The Directory is bound in flexible blue Fabrikoid, fully thumb-indexed, size—4½" x 8½". Price $25.00 per copy. 10% discount on 5 or more copies. For intelligent, productive postwar planning and selling, a copy of the 1945 edition of the McGraw Central Station Directory should be in the hands of every executive responsible for such plans.

Send orders to

Catalog & Directory Division
McGraw-Hill Publishing Company
330 West 42nd St., New York 18, N.Y.

Telegraph Co. in New York, Mr. Holland became assistant to Dempster MacMurphy, vice-president in charge of public relations of the old Middle West Utilities Co., Chicago. He joined the Union Electric Co.'s staff about 12 years ago.

▶ EUGENE ENLOE, a pioneer in electric light and power development in the Big Bend country of Washington, including the formation of the Big Bend Light & Power Co. and the Okanogan Valley Power Co., both of which later were acquired by the Washington Water Power Co., died on August 31 in Spokane. Mr. Enloe retired as president of the Washington Trust Co. in 1941 to attend to his private business. Besides his light and power interests, Mr. Enloe was president of the Idaho Portland Cement Co., president of the Enloe Investment Co., a security holding corporation; president of the Pacific Coast Investment Co., head of the Spokane Realty Co. and was a director of the Washington Water Power Co.

▶ FRANK W. GARRAN, dean of the Thayer School of Engineering at Dartmouth College, died on September 18 in the college infirmary at the age of 51. He was stricken with nephritis four months ago. Associated with Thayer School since 1929, he had been dean since 1934. He recently was chairman of the New England section of the Society for the Promotion of Engineering Education and at his death was a national director of the Society, representing New England. Under Dean Garran's direction during the last eleven years, Thayer added mechanical, electrical and business engineering to the original civil engineering curriculum.

▶ OSCAR C. THAL, general manager of the Kitchener, Ont., Public Utilities Commission since 1940, died August 19 from a lingering illness. He was 54 years old. In 1911, he joined the commission as a junior clerk and rose through the ranks. Though not a college graduate, he studied electrical engineering in his spare time and was admitted to the Association of Professional Engineers.

▶ A. B. PALMER, for many years superintendent of the Ashtabula, Ohio, municipal light plant before its sale in 1928 to the Cleveland Electric Illuminating Co., died on August 9. He was 72 years old.

▶ MORRIS S. EARL, Chicago district manager of the Electric Service Manufacturing Co., Philadelphia, Pa., died suddenly on September 3. Mr. Earl had been connected with the organization since it was formed in 1906.

IT WILL PAY YOU TO REMEMBER THIS SLOGAN...

FIRST
SUCCESSFUL SILICONE SLEEVING

Flexible
Varglas
SILICONE
Products
HEAT RESISTANT

Now, for the first time, an electrical insulation is available that is truly *high-temperature-resistant*. It is based on the newly developed Silicone resins and known as *Varglas-Silicone* electrical insulation, previously produced only for the most critical military needs.

Varglas-Silicone insulation is the first insulating sleeving which can truly be described as heat resistant, while still retaining excellent electrical properties, flexibility and high mechanical strength. Military restrictions have prevented publicizing the many items of war equipment which have been made possible—or materially improved—by the revolutionary characteristics of *Varglas-Silicone* sleeving.

Post-war design or operating conditions may often impose demands for insulation which will remain completely flexible at temperatures as low as -85° F., or which will remain stable at temperatures as high as 200° C. or more. *Varglas-Silicone* products will fulfill these requirements.

Our laboratories, which successfully developed *Varglas-Silicone* have also been engaged in perfecting our other products, to assure you of the finest quality obtainable in any type of electrical tubing and sleeving, whether based on Fiberglas, cotton, rayon, nylon or extruded flexible plastics. And—we will be glad to quote on any special products based on your individual requirements or on ASTM specifications.

VARFLEX CORPORATION
ROME, NEW YORK

FIRST
SUCCESSFUL SILICONE SLEEVING

MANUFACTURING MARKETS

Plastics Advanced 20 Years in Last 5

Nation's plastics materials producing industry progressed 20 years in research during the five years of intensive devotion to war, and as a result there will be no curtailment of employment in the return to a peacetime basis, but probably a slight increase, W. S. Landes, president of the Plastics Materials Manufacturers' Association, said recently.

"Outstanding gains in volume and diversification of plastics products were made in the war years," Mr. Landes said, "and if the United Nations carry through the dismantling of the German chemical and plastics industry, American industry will strengthen world leadership and the fruits of our research in the last two decades will begin to appear.

Volume Up 325 Percent

"Although prices of many types of plastics materials declined during the period from 1939 through 1944, total dollar volume of the industry in the United States increased 325 percent.

"Despite the greatly increased output that was developed to meet war needs, it is indicated that we may have an additional growth of 20 to 25 percent in the predictable future. An important factor in the post-war use of plastics will be the increased use of electronic heating and the availability of new type compression, injection, and extrusion machines for installation in the plants of fabricators and molders. New models designed during the war, but not built for lack of manpower and materials, promise to be more efficient and capable of turning out larger castings at lower cost. This means a large contribution to employment because most machines in service today are obsolete and a large re-tooling program will get under way immediately.

"There will be no battle between plastics and light metal alloys because both types of materials have definite application. . . . "

Mr. Landes believes certain industries will become even greater users of plastics, as complete redesigning comes about.

"The electrical appliance, radio and television, telephone equipment, packaging, insulation, and toy industries all will use greater amounts of many different types of plastic materials."

•

Lepel H. F. Laboratories Buys Van Norman Division

Lepel High Frequency Laboratories, Inc., has acquired the business, goodwill, and assets of the induction heating division of the Van Norman Co., machine tool manufacturers of Springfield, Mass. All raw materials and equipment involved have already been removed to the Lepel plant at 39 West 60th St., New York City, where all manufacturing activities will be centered.

Mr. H. Petersen, president of Lepel, states that present plant capacity is ample for the combined operations and that no personnel changes are involved.

Allegheny Ludlum Plans $2,000,000 Research Lab

Allegheny Ludlum Steel Corp. has placed first on its peacetime expansion program the immediate erection of a modern $2,000,000 research laboratory and experimental center at its headquarters plant, Brackenridge, Pa.

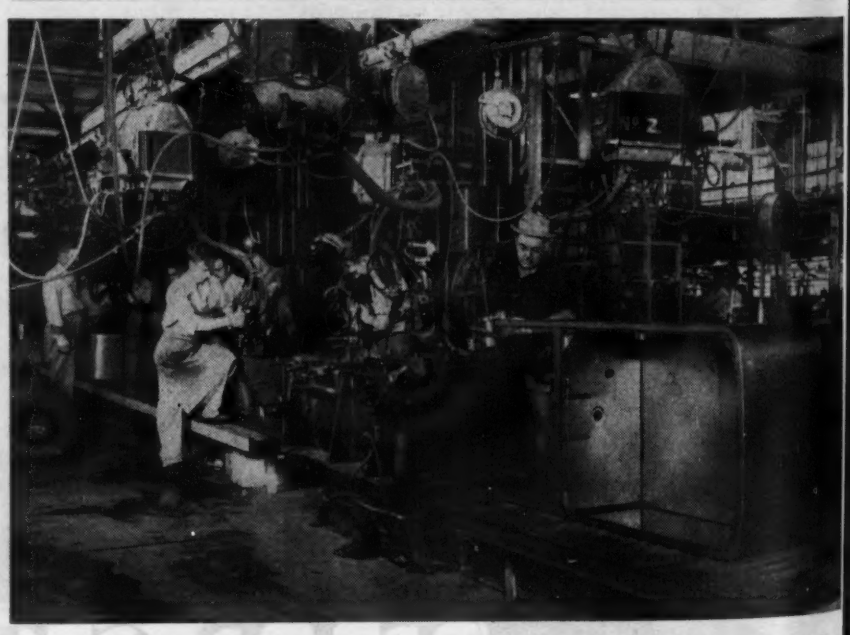
Complete air conditioning, including elimination of dust by electrostatic precipitation, will safeguard delicate scientific instruments and complex experiments. The structure will be of steel frame and brick design, with double insulating glass windows. The main two-story-and-penthouse building will be extended by a one-story furnace section, containing melting and make-up floors, annealing and melting furnaces, and pickling equipment, for experimental work.

With the new facilities, an enlarged and intensified program of fundamental and applied research will be brought to bear on specialized steels. In addition, new and improved fabricating techniques will be developed, to bring increased aid to the manufacturers of appliances and equipment used in homes, businesses and industries.

•

Army-Navy "E's" Awarded

Among the recipients of the Army-Navy "E" award just prior to the discontinuance of the award were the Silent Hoist & Crane Co., Brooklyn, N. Y., fourth renewal, and the Philco Corp., Storage Battery Division, sixth award.

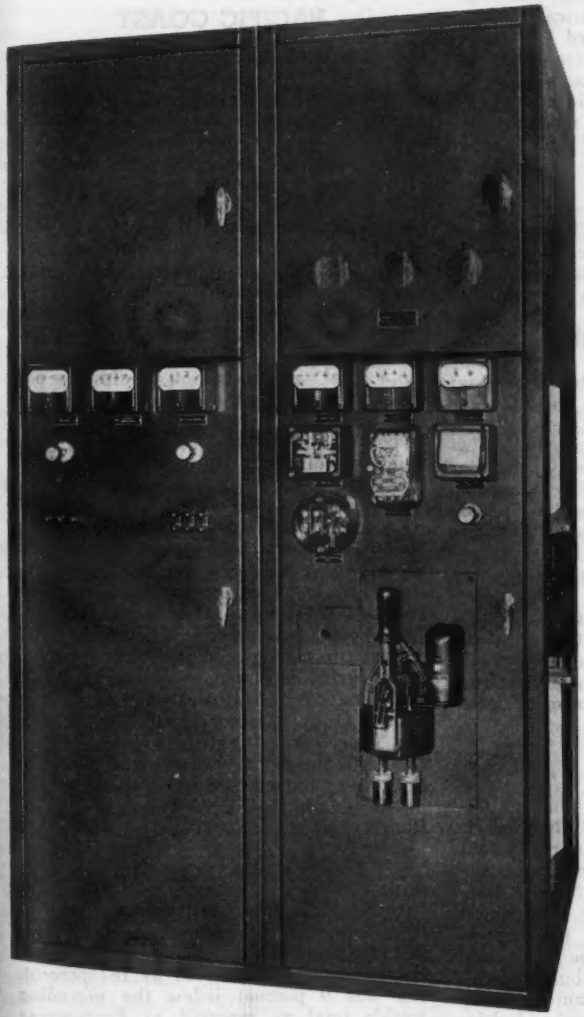


REFRIGERATORS ARE COMING—First refrigerator shells are shown coming off the line at Kelvinator's Grand Rapids plant. While this was going on alteration and improvements were being made in plant facilities to increase assembly line capacity 70 percent. A quarter million square feet is being added to the plant

FOR BETTER DESIGNED SWITCHGEAR

WOLFE & MANN OFFERS

Experienced Engineering Service

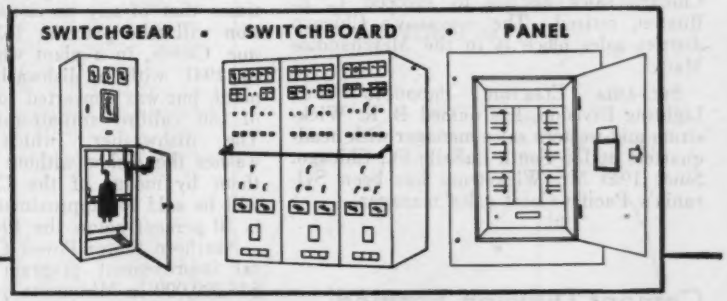


Advanced types of switchgear—for outdoor and indoor service—are promised by Wolfe and Mann, because of our highly trained engineering and manufacturing of this electrical equipment.

Wolfe and Mann regularly manufacture switchgear for well known companies everywhere . . . and offer you its experienced engineering facilities in planning *your* switchgear. First our engineers submit plans to you, and after you approve them . . . we proceed with the manufacture!

Wolfe and Mann employs such modern devices in making switchgear as powerful shears to cut heaviest metal—bending brake processes to form heavy gauge metal to desired shapes . . . punching equipment to stamp recesses for wires and connections!

Thus, with Wolfe and Mann equipment, it is *design* plus *manufacture*. We invite you to submit your switchgear problems to us and let us help you wherever possible. Write today.



WOLFE & MANN MFG. CO.

SWITCHGEAR • SWITCHBOARDS • PANELS

28th and SISSON STREETS • BALTIMORE 11, MD.

Borg-Warner Plans Home Utility Unit

A new home-building unit which consolidates household heating, plumbing, electrical, bath, kitchen and laundry elements including major appliances has been announced by Roy C. Ingersoll, president of the Ingersoll Division, Borg-Warner Corp.

The Ingersoll unit is adaptable to both conventionally built houses and prefabricated houses ranging in price from $3,000 to $10,000. Mr. Ingersoll said that he had commissioned seven of America's outstanding architects to design 12 homes to show the flexibility and practical operation of the unit. These homes are now in process of construction at Kalamazoo, Mich.

The core of the unit is a self-contained package which can be rolled through the door framework and yet is so engineered for accessibility that a man can get inside and service it. Around two sides of the central core are work counters with wall and counter cabinets, sink, range, refrigerator and many innovations in cabinets and accessories which are made possible by integrated design. Adjacent to the kitchen facilities is complete laundry equipment. On the third side are grouped bathroom fixtures and accessories designed for maximum utility. Functional lighting has been provided as an integral part of the kitchen, bathroom and laundry. The entire unit is mechanically ventilated.

•

Manufacturers Make Sales Assignments

Electrical manufacturing companies have recently made the following appointments to their sales staffs:

Edison General Electric Appliance Co. has appointed H. W. Nagel manager of the Chicago sales district to succeed L. E. Buxton, retired. The company's Chicago district sales office is in the Merchandise Mart.

Sylvania Electric Products Inc., Lighting Division, has named B. K. Wickstrum mid-western sales manager with headquarters at 135 South LaSalle St., Chicago. Since 1943 Mr. Wickstrum has been Sylvania's Pacific Coast sales manager.

•

Cement Division Formed

A new division has been formed by the Industrial Tape Corp., New Brunswick, N. J., to produce rubber-based and resin-based cements used in bonding rubber, metals, plastics and other materials.

Field Reports on Business

Further improvement in the progress of reconversion has become evident, as production in some manufacturing lines advance. In the electrical field the demand for watthour meters, wiring supplies, small motors and switch and control apparatus is urgent. Retail trade continues active.

NEW ENGLAND

New England is at present able to supply only a small fraction of the orders for electrical equipment being booked. The demands for watthour meters, wiring supplies, small motors, switch and control apparatus are very urgent and bookings are being entered for deliveries over a year hence in many instances. Engineering offices are busy with plans for factory and plant additions and lighting materials are among the most urgent demanded. In the meantime plans are maturing for many large-scale projects which will stimulate even more activity in the electrical market.

In Cambridge, Mass. Harvard University and the Massachusetts Institute of Technology have expansion programs planned to total more than $15,000,000 in new buildings and equipment. Among the most recent plans for additions to "M.I.T." is a new gas turbine laboratory for which about $500,000 has been set aside. Cambridge Housing Authority has applied for a permit to start construction of 1750 dwellings and the city manager last week disclosed plans for extensive traffic improvements which should spur interest in street lighting material.

Interest in schoolroom lighting is increasing. Salem, Mass., has set apart a fifth grade room in the Bowditch School as a working field laboratory in this branch of illumination for Sylvania Electric Products, Inc. This company has formed a division for the production of electronic control apparatus of a wide diversification and has acquired facilities in Boston for carrying on this program. Bethel, Vt., has increased its street lighting by replacing 16 60-cp. lamps in the business area by 400-cp. lamps. About 100 other street lamps in this town and East Bethel are to be increased from 60 to 100 cp. Connecticut manufacturers are booking small lots of knife switches, wiring supplies, and insulating materials for government overseas installations.

CHICAGO

Production will begin in Chicago October 15 on the new Hotpoint dishwasher, with 1946 volume expected to reach four times that of any previous year. Production will take place at 1531 S. 54th Avenue, Cicero, in a plant which was bought in 1941 with a dishwasher program in mind, but was converted to the production of .50 calibre anti-aircraft bullet cores. The dishwasher, which automatically washes the dishes without soap and dries them by means of the Calrod principle, will be sold for approximately $175, which is 30 percent below the 1942 price.

Northern States Power Co. plans a capital improvement program of more than $25,000,000 in Minnesota and Wisconsin in the next five years. This compares with $3,000,000 spent in the past year and $26,000,000 in the past five years.

Chicago Surface Lines contemplates a $22,000,000 improvement outlay for 1,275 new buses and street cars, converting 22 street car lines to buses, modernizing four heavily-traveled lines, installing new express bus lines and making several extensions. Purchases will include 210 trolley buses and 400 modern street cars. These are in addition to the 195 motor buses and 200 street cars ordered last spring.

Major construction programs soon to get under way are a $2,000,000 research laboratory for Standard Oil at Whiting, Ind.; a $200,000 building for the Illinois Auto Electric Co., 21st St. and Indiana Av.; new divisional headquarters addition for Public Service Co. of Northern Illinois in Northbrook and a factory and office for Royal Electric Mfg. Co. on Greenwood Av. near 87th St.

PACIFIC COAST

The August total value of building permits in the seven western states decreased very slightly from July but was 60 percent above the August, 1944, total, with all states registering in proportion except Washington's 10 percent increase. Removal of building restrictions on October 15 is expected to start home-building boom, especially in San Francisco and adjacent peninsula. Electrical material will be available for such projects as they mature, but lumber may prove a bottleneck.

Major government construction, which is proceeding for certain permanent installations, includes a $5,166,000 low bid for shops and administration buildings for Inyokern naval ordnance testing station; facilities for reserve fleet at Mare Island to cost $2,641,000 and $490,630 award for Hunters Point, all being California location.

Prospective business includes a $249,000 REA allotment for Blaine County, Mont.; 89 miles of rural lines near Kalispel in northwestern Montana; and projected construction of 300 miles of transmission line and two substations, costing $400,000 for Coos Cooperative near Coquille, Ore., and several runway lighting jobs.

Industrial developments cover an $800,000 plant for Northwest Corp. at The Dalles, Ore.; a factory near Los Angeles for Thor major electrical appliances; a $500,000 automotive parts plant for Ford at Denver; and a $1,250,000 exchange building for Mountain States Telephone Co. at Phoenix.

NEW YORK

Civil engineering construction volume in continental United States totaled $55,188,000 last week. This volume topped the corresponding week last year by 187 percent, but was 9 percent below the preceding week's total as reported to *Engineering News-Record*. Private construction for the week, the highest reported since the week of June 3, 1943, topped the corresponding 1944 week's volume by 815 percent, and was 0.2 percent above the 1945 second high of a week ago. The week's construction brought 1945 volume to $1,407,437,000 for the 38 weeks, a four percent increase over the $1,348,716,000 reported for the period in 1944.

Retail trade, while somewhat affected by adverse weather, continued quite active in the Metropolitan area last week. Estimates put department store sales at about 15 percent ahead of last year.

Sales Opportunities

IDAHO—Idaho Power Co., Boise, has plans maturing for new hydroelectric generating station at Upper Salmon Falls, Hagerman, supplementing present power plant of same type. Project is estimated to cost about $5,500,000, of which approximately $2,750,000, will be used for power plant, including hydraulic turbines, generators and auxiliary equipment. A new transmission line will be built from Hagerman Valley to Emmett and vicinity, about 138 miles, to cost about $1,250,000, with switching station and other operating facilities. Extensions in rural electric system will represent about $1,500,000. Work is scheduled to begin in near future.

OHIO—Youngstown Sheet & Tube Co., Youngstown, plans expansion in plant, comprising three large additions for extensions in cold rolling mill, finishing mill and wire-drawing plant, respectively, with machinery and electrical equipment. Cost reported over $4,000,000. Program will be placed under way in October.

IOWA—City Light Department, Forest City, W. C. Haugland, city clerk, will receive bids until October 11 for extensions in municipal power plant, including new diesel engine-generating unit, complete with exciter and auxiliary equipment, piping and electrical work, intake silencer, air filter, etc., as per plans and specifications on file. Stanley Engineering Co., Muscatine, is consulting engineer.

WISCONSIN—City Council, La Crosse, has approved plans for ornamental lighting system and bids are scheduled to be asked at once. J. H. Barth is city engineer, in charge.

NEW YORK—F. & M. Schaefer Brewing Co., 430 Kent Ave., Brooklyn, plans several new multi-story additions to plant for large increase in present capacity, including brew-house and bottling departments. Also will build addition to power plant, with installation of additional equipment for larger output. Entire project will cost approximately $2,000,000, with mechanical and electrical equipment. Completion is scheduled next spring, when work will begin on further extensions, to represent an additional investment of about $2,500,000. Eggers & Higgins, 542 Fifth Ave., New York, are architects.

WASHINGTON—Bonneville Power Administration, Department of Interior, Failing Bldg., Portland, Ore., will ask bids soon for new control station and oil house at Longview, in connection with substation yard facilities for new 230,000-volt transmission line from North Vancouver to Chehalis and Covington. Entire project is estimated to cost about $1,600,000.

INDIANA—Northern Indiana Public Service Co., Gary, has approved plans for new pumping station for water system on local site on 41st Ave., with motor-driven pumping equipment, controls, etc. Beine, Hall & Curren, 607 Broadway, Gary, are architects.

GEORGIA—Hercules Powder Co., Delaware Trust Bldg., Wilmington, Del., plans expansion in naval stores plant at Brunswick, comprising several new one and multi-story buildings with machinery and electrical equipment for large increased capacity of rosin and resinous products, liquid specialties, etc. Entire program will cost about $1,250,000 and is scheduled to proceed at once.

KANSAS—City Council, Coffeyville, Lois Saunders, city clerk, will receive bids until October 11 for new 10,000-kw. turbine-generator and surface condenser, 10,000-sq. ft. rating, with accessories, for installation in municipal power plant, where expansion will be carried out. Entire project is estimated to cost close to $250,000. Black & Veatch, 4706 Broadway, Kansas City, Mo., are consulting engineers.

MICHIGAN—Public Lighting Commission, Detroit, is having plans completed for new municipal steam-electric generating station. Tract of 10 acres of land was acquired a number of months ago, with project held in abeyance as a post-war development. Fund of $350,000 has been arranged, partly through federal aid, for engineering work, including preparation of plans. New plant will have an initial rated capacity of 35,000 kw., and is estimated to cost approximately $5,421,000. Bids are expected to be asked in near future. Smith, Hinchman & Grylls, Marquette Bldg., Detroit, are architects. Burns & Roe, Inc., 233 Broadway, New York, N. Y., is consulting engineer.

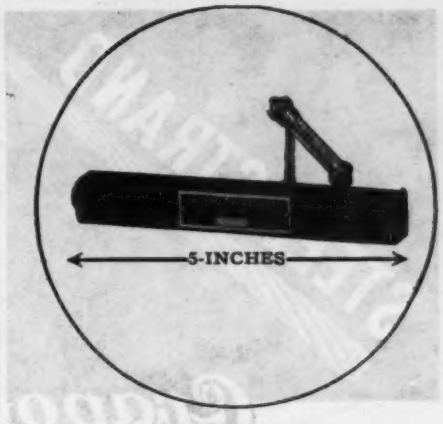
CONNECTICUT—Stanley Works, New Britain, tools, hardware, steel stampings, etc., plans two new six and seven-story additions, 140 by 200 ft., and 200 by 200 ft., respectively, for large increased output. Cost close to $1,200,000, with machinery and electrical equipment. Erection is scheduled to begin at once. J. H. Fellows, New Britain, is engineer.

IOWA—Sioux City Gas & Electric Co., Sioux City, has purchased tract of land at Fifth and Jackson Sts., and will use as site for new three-story operating center and office building, about 100 by 100 ft., estimated to cost approximately $200,000, with equipment and facilities. Plans will be prepared soon.

TEXAS—Jefferson Chemical Co., 30 Rockefeller Plaza, New York, N. Y., has plans in progress for new plant at Port Neches, where tract of over 1,000 acres of land was acquired a number of months ago, to consist of a group of one and multi-story processing and production buildings for line of chemical products. Machinery and electrical equipment will be installed for large capacity. Also will build power plant, transformer stations, pumping plant and other utility structures. No official estimate of cost announced, but reported in excess of $3,500,000. Company is a joint subsidiary of American Cyanamid Co., first noted address, and Texas Co., 135 East 42nd St., New York. H. L. Derby is president.

MICHIGAN—Department of Buildings, Lansing, has preliminary plans under way for new power plant at Michigan School for Deaf, Flint. Details and estimates of cost will be determined at early date. O'Dell, Hewlett & Luckenbach, Dime Bank Bldg., Detroit, are architects.

MARYLAND—Consolidated Gas, Electric Light & Power Co., Baltimore, plans installation of new dust and soot collector system at generating stations, reported to cost close to $1,000,000.



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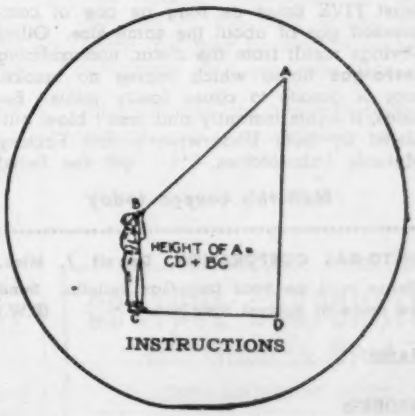

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Recent Rate Changes

BUFFALO NIAGARA ELECTRIC CORP. and Niagara, Lockport & Ontario Power Co., will reduce electric rates to commercial customers $150,000 annually, Col. William Kelly, president of both companies, has announced. The reduction will affect approximately 35,000 customers in western New York. "While the cut is aimed principally at reducing the electric bills of the smaller consumers of electricity in the so-called commercial classification, every one of them will save something, depending on their monthly consumption," the company said.

GEORGIA POWER & LIGHT CO. has been ordered by the state Public Service Commission to reduce its wholesale power rates to REA co-operatives for resale to farm customers 10 percent. The order stipulated that the reduction in the wholesale rate should apply only on energy delivered for resale to small retail consumers, "the provision of service to whom was the basic reason for the formation of the Rural Electrification Administration." Power sold to the cooperatives for resale to war plants and for large non-farm use will not be affected.

NEW MEXICO PUBLIC SERVICE COMMISSION has approved rate reductions submitted by three New Mexico electric power companies, resulting in an aggregate annual saving of $14,500 to most classes of light and power customers. The El Paso Electric Co., Mesilla Valley Division, the Southwestern Public Service Co., Clovis and Pecos Valley Divisions, and the Inland Utilities Co. were the companies to voluntarily make application for reducing rates.

APPALACHIAN ELECTRIC POWER CO. will reduce its electric power rates furnished to public schools 2 cents per kw.-hr., thereby reducing the school light bill by 60 percent. The utility company also indicated that power lines will be extended to schools in 29 counties within three years without cost to the local communities or the state.

OHIO EDISON CO.'s proposal to reduce power rates in Youngstown has been adopted by City Council after several months of study. The company estimated that the measure would save commercial users and the city in its white way system approximately $1,000,000 in five years. The rate reductions were in return for a 12-year extension (1957 to 1969) of the utility's basic operating franchise. The commercial rate is cut 9.7 percent, bringing an estimated saving to commercial users of $158,000 a year. Expiration date on this rate is June 1, 1948, a year later than provided in the present contract. The city will also save $146,000 in 1945 on its street lighting costs, and the street-lighting savings after this year will be 10 percent a year. The new street-lighting contract will run five years and may be extended an additional five years by mutual agreement. Residential consumers receive no reduction. The contract covering their rates is extended one year to June, 1948, to expire at the same time as the new commercial rate. The measure also included a change in the penalty clause covering late payments. This provision eliminates the present gross rate charge and substitutes a 5 percent penalty for late payment.

HOUSTON LIGHTING & POWER CO. customers will have their light bills cut $595,000 for the year beginning September 25. This is the twenty-first rate reduction in the thirty years during which Houston Lighting operated under a "profit-sharing" agreement with the City of Houston. The agreement was cancelled by the city in August. In its place will be an "operating agree-

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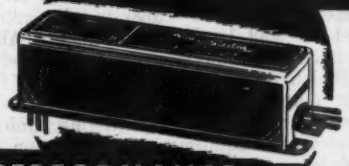

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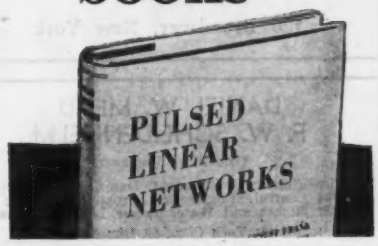

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New REA Allotments Total $6,620,000

The Rural Electrification Administration has recently announced the approval of allotments totaling $6,620,000 to 35 rural cooperatives in 23 states. The allotments, most of which will be used for line construction to extend electric service, are listed below.

GEORGIA—Coastal Electric Membership Corp., Midway, $129,000.

ILLINOIS—Illinois Rural Electric Co., Winchester, $170,000, generating facilities.

INDIANA—Hendricks County Rural Electric Membership Corp., Danville, $135,000.

IOWA—Cooperative Electric Co., St. Ansgar, $138,000; Calhoun County Electric Cooperative Assn., Rockwell City, $100,000; Cherokee County Rural Electric Cooperative, Cherokee, $36,000.

KANSAS—Jewell-Mitchell Cooperative Electric Co., Inc., Ionia, $250,000.

KENTUCKY—Big Sandy Rural Electric Cooperative Corp., Prestonsburg, $50,000.

LOUISIANA—Valley Electric Membership Corp., Natchitoches, $65,000.

MISSISSIPPI—Tallahatchie Valley Electric Power Assn., Batesville, $290,000; Delta Electric Power Assn., Greenwood, $274,000; Monroe County Electric Power Assn., Amory, $50,000.

MISSOURI—Boone County Cooperative Electric Assn., Columbia, $126,000.

NEBRASKA—North Central Nebraska Rural Public Power District, Creighton, $325,000; Panhandle Rural Electric Membership Assn., Alliance, $300,000; Stanton County Rural Public Power District, Stanton, $150,000; Southern Nebraska Rural Public Power District, Grand Island, $106,000.

NEW MEXICO—Farmers' Electric Cooperative, Inc., Clovis, $330,000.

NORTH CAROLINA—Jones-Onslow Electric Membership Corp., Jacksonville, $301,000.

NORTH DAKOTA—North Central Electric Cooperative, Inc., Bottineau, $200,000.

OHIO—Buckeye Rural Electric Cooperative, Inc., Gallipolis, $170,000.

OREGON—Lane County Electric Cooperative, Inc., Eugene, $350,000, with previous allotment to build distribution and transmission lines and four substations.

SOUTH DAKOTA—Lake Region Electric Assn., Inc., Webster, $330,000; Lincoln Union Electric Co., Alcester, $158,000.

TENNESSEE—Upper Cumberland Electric Membership Corp., Carthage, $460,000; Pickwick Electric Membership Corp., Selmer, $160,000.

TEXAS—Comanche County Electric Cooperative Assn., Comanche, $261,000; San Patricio Electric Cooperative, Inc., Sinton, $157,000.

VERMONT—Halifax Electric Cooperative, Inc., Brattleboro, $124.000.

VIRGINIA—Prince William Electric Cooperative, Manassas, $193,000, which includes funds for generating facilities.

WASHINGTON—Ferry County Public Utility District No. 1, Republic, $420,000.

WISCONSIN—Oconto Electric Cooperative, Oconto Falls, $125,000 for generating facilities; Oakdale Cooperative Electric Assn., Oakdale, $80,000 for extensions and $18,000 for headquarters; Jackson Electric Cooperative, Black River Falls, $52,000.

WYOMING—Hot Springs County Rural Electric Assn., Inc., Thermopolis, $37,000.

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